THE ATLANTIC FERRY

A. J. MAGINNIS

THE ATLANTIC FERRY

THE WHITE STAR LINE. OCEANIC (1899).

Frontispiece, see page 104.

THE ATLANTIC FERRY

ITS SHIPS, MEN, AND WORKING

BY

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PREFACE.

THE importance and extent of the Transatlantic steam trade has, ever since its commencement, been the occasion of many interesting articles in magazines, newspapers, and scientific periodicals; but, so far as I can trace, no publication has yet been issued which would, in itself, give an ordinary reader or passenger an idea of the routine, forethought, and general arrangements necessary to carry on such a far-reaching organization as a great steamship line, and which would, at the same time, set forth the various efforts of the noted merchants and scientists who have initiated and carried on the service, and also the nature and results of the more remarkable examples of vessels and machinery which they have employed.

It may perhaps be thought that the chapters relating to the working and management are somewhat brief; but in a book of this kind it would not serve any purpose to describe minutely the minor details of the various departments, or duties appertaining to individuals; consequently, only such leading points are described as would serve to show the general system by which the organization is carried on.

The chapters devoted to a description of the inspection made by the Governmental Supervising Authorities will, I trust, be reassuring to those who, for health, pleasure, or business, are constantly travelling by the great Liners, as they fully explain the careful and searching nature of the inspection and survey which is made periodically by an able staff of Surveyors, to insure safety under all circumstances; and as these gentlemen are solely in the service of their respective Governments, they are removed from all liability of being influenced by any personal interest or question of cost to the shipowners, which may be entailed by the due fulfilment of the requirements enacted from time to time.

The retrospect of the trade was, in a brief form, brought forward in a paper entitled "Transatlantic Lines and Steamships," read by me before the Liverpool Engineering Society in 1878, then in its infancy, but now one of the most important associations in the provinces. Owing to the favourable manner in which that paper was received, I have since continued to keep note of all the leading events and records, and from this material I have endeavoured to produce a handy and simple book of reference for the numbers engaged in the Atlantic service, and also for the thousands of passengers who are ever passing to and fro on the great Ferry.

With a view of rendering the work pleasant and agreeable reading, all harrowing descriptions of losses which have occurred have been purposely omitted; mention of some being made in a few cases where brief reference is unavoidable, but the general particulars of the vessels

lost, if required, will be found fully set out in Table No. 7.

The events noted of the earlier periods are almost all gathered from my own scrap-book; those of the later periods have either come directly under my own experience, or are from information kindly given by various firms and gentlemen formerly, and at present, engaged in the trade, to whom I must express my indebtedness.

A. J. M.

CENTRAL BUILDINGS, NORTH JOHN STREET,
LIVERPOOL, *March* 1892.

PREFACE TO THIRD EDITION.

SINCE the publication of the first and second editions in 1891 and 1892, I have received from far and wide many interesting and kindly letters from total strangers bearing upon the doings of the early steamships, and calling attention to many events which had either never been recorded, or had been but briefly noticed, and then passed into oblivion.

Many of these events I found on examination did not possess such enduring features as would now justify notice, but others were of special importance, and are inserted as fully as circumstances would permit.

So interesting and pathetic were many of these letters, that brief extracts from them would, I am of opinion, not be out of place.

One of the earliest, from a clergyman in a large York-

shire city, who, expressing his thanks, terms it "the fascinating and instructive *Atlantic Ferry*," and states "that the boats connected with the Mersey are to me like old friends, and the charming book with its graphic touches and wonderful detail has enabled me to live over again the days of my youth, and all who have known anything about the Atlantic Ferry owe you an immense debt of gratitude for a book which none can read without the deepest interest and lasting profit."

Another writer states—"I have read with much interest your book, *The Atlantic Ferry*, and am indebted to it for a good deal of information. There is one ship you mention and illustrate which is deserving of more than a passing notice," and then, like numerous others, refers to some vessel or vessels of which he personally has experience.

To one correspondent I am indebted for supplying an omission, which he tersely calls attention to as follows—"Have just read your very interesting *Atlantic Ferry*. There was an attempt to run an American Line of timber-built screw-steamers to Liverpool about 1868." Memory does not readily bridge over the space of twenty-four years to enumerate particulars, but I was once on board of one in the Brunswick Dock, and had a look into the engine-room. I do not now recollect all the peculiar malformations in the machinery, but to put it mildly, they were "fearfully and wonderfully made." The vessels were weak in the region of the stern, and altogether unfit for the trade, and were soon withdrawn.

From across the Atlantic another correspondent wrote—

"I have recently got from the library your book on the *Atlantic Ferry*, which I have read with very much interest, but fancy I have discovered some errors in the casualty table."

Following this, the descendant of one who has left his mark on the Ferry, writes from the sunny shores of Italy—"To any one who knows anything of the Transatlantic Service your delightful book cannot but be most interesting, and it cannot fail to become the standard work on the subject, and prove invaluable for reference. It is in consequence of this I beg to call your attention to one omission, at which I am the more surprised, as you yourself must be well acquainted with the facts," and he then favours me with an interesting addition to the work.

Aided somewhat by the foregoing and other correspondents, and further research and inquiry, I have been able to add still more information of the interesting but rather obscure doings of earlier days, and I would like especially to acknowledge the valuable help and assistance given by my young friend, Mr. Francis B. C. Bradlee, of Boston, U.S.A., who although an invalid and compelled by ill health to winter in the Riviera, has aided me in carrying out extensive inquiries and researches in reliable documents, which, thanks to his care and exactitude, have enabled me to revise and amplify many of the statements and tables relating to the early American, French, Galway, and other past Lines.

One special feature of the utility and extensive use of the former editions which has encouraged me in keeping fully alive to the progress of Transatlantic events, is the

continuous use made by the daily press of the book, which, although not mentioning their authority, now almost daily supply correct answers to correspondents, or quote word for word when writing upon kindred subjects.

That the present edition may be as widely read and appreciated as the two former I sincerely hope, and I would beg of all who have or know of any ancient documents, illustrations, or such like bearing upon this great trade, to favour me by supplying still further data which will enable *The Atlantic Ferry* to be still more and more the standard reference for information bearing upon that great highway of commerce.

ARTHUR J. MAGINNIS.

CHAPEL CHAMBERS NORTH,
28 CHAPEL STREET, LIVERPOOL, 1900.

ATLANTIC RECORDS AND EVENTS.

				DATE	PAGE
First	steamer	to cross the Atlantic	**Savannah**	1819	4
,,	British steamer	,,	**Royal William**	1833	6
,,	Passenger vessel	,,	**Second Royal William**	1838	7
,,	Cunard Line . .	,,	**Britannia**	1840	25
,,	Collins Line	,,	**Atlantic**	1850	46
,,	Inman Line	,,	**City of Glasgow**	1850	55
,,	Allan Line	,,	**Canadian**	1854	72
,,	Anchor Line . . .	,,	**Tempest**	1856	71
,,	National Line . .	,,	**Louisiana**	1863	79
,,	Guion Line	,,	**Manhattan**	1866	81
,,	White Star Line . .	,,	**Oceanic**	1871	89
,,	American Line . .	,,	**Pennsylvania**	1873	112
,,	Hamburg-American Line	,,	**Borussia**	1856	126
,,	North German Line	,,	**Bremen**	1858	129
,,	French Transatlantique	,,	**Lafayette**	1863	133
,,	Atlantic screw steamer	,,	**Great Britain**	1845	16
,,	,, iron steamer	,,	**Great Britain**	1845	16
,,	,, iron paddle steamer	,,	**Persia**	1856	35
,,	,, twin-screw steamer	,,	**Notting Hill**	1881	122
,,	,, compound engines	,,	**Holland**	1869	79
,,	,, compound 3-crank engines	,,	**Arizona**	1879	83
,,	,, triple-expansion engines	,,	**Martello**	1884	179
,,	,, express twin screw	,,	**City of New York**	1888	65
,,	,, steel steamer	,,	**Buenos Ayrean**	1879	41
,,	,, midship saloons	,,	**Oceanic No. 1**	1871	89
,,	,, steamer lost	,,	**President**	1841	15
,,	lit with gas	,,	**Adriatic,** White Star	1872	100
,,	lit with electric light	,,	**City of Berlin**	1879	63
,,	wooden screw vessel	,,	**Ontario**	1868	53
Last	**wooden paddle vessel built**	.	Collins **Adriatic**	1857	47
,,	**sailing of Collins Line** . .	.	**Baltic**	1858	48

			DATE	PAGE
Last side-lever engines	Cunard **Scotia**		1862	36
,, *British* paddle-wheel built . .	Cunard **Scotia**		1862	36
,, paddle-wheel built	French **Napoleon III.**		1865	134
Oldest vessel now in Atlantic Trade .	**Waesland** (late Cunard **Russia**), built		1867	113
Longest steamer afloat . . .	**Oceanic**	704 feet over all		104
Greatest displacement afloat .	**Oceanic**	26,090 tons		104
,, ,, ever built.	**Great Eastern**	32,160 ,,		124
,, indicated horse-power, paddles	**Great Eastern**	5,000 I. H. P.		124
Greatest indicated horse-power, single screw. . . .	**Etruria**	14,500 ,,		42
Greatest indicated horse-power, twin screw.	**Kaiser Wilhelm der Grosse**	32,000 ,,		130
Greatest daily consumption, paddles	**Scotia**	165 tons		36
Greatest daily consumption, screw.	**Kaiser Wilhelm der Grosse.**	520 ,,		130
Greatest average speed per hour, paddles	**Scotia**	13½ knots		36
Greatest average speed per hour, single screw	**Etruria**	19 ,,		42
Greatest average speed per hour, twin screw.	**Kaiser Wilhelm der Grosse**	22·9 ,,		130
Greatest distance run in one day .	**Kaiser Wilhelm der Grosse**	580 ,,		130

QUEENSTOWN TO NEW YORK

				d.	h.	m.
First passage, under 9 days,	1864,	Cunard **Scotia**	.	8	15	4
,, ,, 8 ,,	1872,	White Star **Adriatic**	.	7	23	17
,, ,, 7 ,,	1884,	Guion **Oregon**	.	6	9	42
,, ,, 6 ,,	1889,	Inman **City of Paris**	.	5	19	18

NEW YORK TO QUEENSTOWN.

First passage, under 9 days,	1863,	Cunard **Scotia**	.	8	3	0
,, ,, 8 ,,	1869,	Inman **City of Brussels**	.	7	22	3
,, ,, 7 ,,	1882,	Guion **Alaska**	.	6	22	0
,, ,, 6 ,,	1889,	Inman **City of Paris**	.	5	23	38

Fastest passage,	1840, Cunard **Acadia**,	Liverpool to	Halifax	11	4	0
,,	1846, Cunard **Cambria**	,,	,,	10	22	0
,,	1848, Cunard **Europa**	,,	New York	11	4	0
,,	1851, Collins **Baltic**	,,		9	18	0
,,	1864, Cunard **Scotia**	Queenstown		8	15	45

			d.	h.	m.
Fastest passage,	1867, **City of Paris**	Queenstown to New York	7	23	17
,,	1872, White Star **Adriatic**	,, ,,	8	4	1
,,	1876, White Star **Britannic**	,, ,,	7	13	11
,,	1880, Guion **Arizona**	,, ,,	7	10	47
,,	1884, Guion **Oregon**	,, ,,	6	9	42
,,	1887, Cunard **Umbria**	,, ,,	6	4	42
,,	1889, Inman **City of Paris**	,, ,,	5	19	18
,,	1891, White Star **Teutonic**	,, ,,	5	16	31
,,	1892, Inman **City of Paris**	,, ,,	5	14	24
,,	1894, Cunard **Lucania**	,, ,,	5	7	23
,,	1898, North German **Kaiser Wilhelm der Grosse**	,, ,,	5	4	40[1]
,,	1841, Cunard **Britannia,**	Halifax to Liverpool	9	21	0
,,	1852, Collins **Arctic,**	New York to ,,	9	17	15
,,	1856, Cunard **Persia,**	,, Queenstown	9	4	45
,,	1863, Cunard **Scotia**	,, ,,	8	3	0
,,	1869, Inman **City of Brussels**	,, ,,	7	22	3
,,	1875, Inman **City of Berlin**	,, ,,	7	15	28
,,	1876, White Star **Britannic**	,, ,,	7	12	47
,,	1882, Guion **Alaska**	,, ,,	6	22	0
,,	1887, Cunard **Etruria**	,, ,,	6	4	36
,,	1889, Inman **City of Paris**	,, ,,	5	22	50
,,	1891, White Star **Teutonic**	,, ,,	5	21	3
,,	1892, Inman **City of New York**	,, ,,	5	19	57
,,	1894, Cunard **Lucania**	,, ,,	5	8	38
,,	1898, North German **Kaiser Wilhelm der Grosse**	,, ,,	5	6	21[2]

NOTED STEAMERS.

1819 TO 1840.

1840 TO 1850.

[1] Duration of passage based on speed per hour on trip from Southampton to New York.

[2] Duration of passage based on speed per hour on trip from New York to Southampton.

NOTED STEAMERS—*continued.*

1880 TO 1890.

1890 TO 1899.

NOTED STEAMERS—*continued.*

1840 to 1850—*continued.*

1850 TO 1860.

1860 TO 1870.

1870 TO 1880.

NOTED STEAMERS—*continued.*

1880 TO 1890.

1890 TO 1899.

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LIST OF ILLUSTRATIONS.

FUNNELS, FLAGS, AND NIGHT SIGNALS OF THE ATLANTIC FERRY.

LINE.	FUNNELS.	FLAGS.	NIGHT SIGNALS.
Guion (*extinct*)	Black, red band, and narrow black top.	Blue, white diamond, black star in centre	Blue lights forward, aft, and on bridge simultaneously.
Hamburg-American	Black	White and blue, anchor, shield, and letters H.A.P.A.G.	Three Roman candles at stern of vessel, each showing seven stars as follows :—white, red, blue, white, red, blue, white.
Inman, to 1886 (*extinct*)	Black, white band and black top.	Red, with white square, having black diamond.	Blue light forward and aft, and red light on bridge, and rocket.
Johnston	Red, with white and blue band and black top.	Red, with blue diagonal stripes, and letters W. J. & Co.	Red light forward, two blue amidships, and white aft, all burning simultaneously.
Leyland	Buff, and black top	Red flag, square	Three red lights in succession.
National	White, with black top	Red Union Jack, ground white, cross in centre.	Blue light forward and aft, and red light on bridge.
Nav. Gen. Italiana	Black, white and black.	Red and white ground, lion and red cross	Red, green, white, red Coston light.
Netherlands	Black, white band, green border	Green, white and green, N.A.S.M. in centre.	Green, white and green lights.
North German Lloyd	Cream	White, blue key, and anchor crossed oak leaf wreath.	Two blue and red Coston lights changing together.
Red Star	Black, with white stripe	White with red star	Three red lights forward, bridge and aft.
State (*extinct*)	Buff, with red ring under black top.	Blue swallow-tail, with red and white stripes at top and bottom, and letter S in centre.	Red light forward, blue amidships, and red aft, simultaneously.
Transatlantique	Red, with black top	White, red ball in corner, and letters C.G.T.A.	Blue light forward, white light amidships, red light aft.
Thingvalla (*extinct*)	Yellow, white band, blue stars	White, with seven pointed blue stars	White, red, red, white Coston light.
Twin Screw Line (*extinct*).	Cream, with bell-mouth top	White, with two red screw propellers	Blue, red and blue.
White Star	Cream, black top	Red swallow-tail, with white star	Two green lights simultaneously.
White Cross	Yellow, black top	Red, with white cross	Green, white, green Coston light.
Wilson	Red, with black top	White pennant, with red ball	Two red lights.
Warren	Black	Red flag, square, white diamond in centre	Red light forward, white amidships and green aft.

THE ATLANTIC FERRY.

CHAPTER I.

THE EARLY ATLANTIC STEAMERS.

STRANGE as it may seem to the present generation of travellers, it is nevertheless true, that it is but some sixty years since the sailing clippers had things all their own way upon the Atlantic highway. The Black Ball Line of sailing vessels, founded in New York in 1816, with its vessels the **Pacific**, **New York**, **Canada**, and others, boasted an average passage of forty days out to New York, and twenty-three days home to Liverpool; but records are also given in an old English paper called the *Literary Panorama,* dated June 1815, in the author's possession, of a ship named the **Galatea** having sailed from St. John's, Newfoundland, in eleven days to Portsmouth without having made a single tack. Following these are the **Red Jacket**, the **Harvest Queen**, the **Independence** (which, although built so far back as 1834, made a passage to Liverpool in fourteen days), the **Sovereign of the Seas**,[1] and the **Dreadnought**, the latter of which may be termed the last

[1] See p. 244.

specimen of the famous American clipper fleet. This vessel, the **Dreadnought**, became very celebrated by having made the passage from New York to Liverpool under fourteen days in 1858, and from New York to Queenstown in nine days seventeen hours. She was long in active service, and eventually was wrecked in 1890 on the American coast. Some of these sailing clippers gained great renown in the early days of steam navigation by beating the steamers themselves, notably the clipper **Tornado**, of the Morgan line, which, in 1846, arrived in New York before the Cunard steamer, which sailed at the same time, arrived in Boston.

Before describing the steamships of the Atlantic trade it will not be out of place to relate briefly the early efforts made to apply steam-power to the propulsion of vessels.

The first attempt to propel vessels by steam is claimed by the Spanish to have been made at Barcelona, by a paddle-wheel vessel, under the direction of Blasco de Garey, in 1543. Papin, in France, about 1707; Jonathan Hulls, in England, in 1736; William Henry, in Pennsylvania, United States, also are mentioned in connection with it; but the first steamer worthy of being so called was that of John Fitch, which he placed for hire upon the Delaware, at Philadelphia, in 1787. This primitive craft was propelled by a system of paddles or oars working vertically, and was the forerunner of the palatial vessels now plying on the great rivers of the United States. Some remarkable statements of John Fitch, as showing how far-seeing he was, deserve mention. It is stated that, on writing to a friend for the loan of £50 to finish this boat, he stated—

"This, sir, whether I bring it to perfection or not, will be the mode of crossing the Atlantic, in time, for packets and armed vessels." And on another occasion, when praising his hobby to two visitors, he made use of the following words—

"Well, gentlemen, although I shall not live to see the time, you will, when steamboats will be preferred to all other means of conveyance, especially for passengers." After which, one visitor said to the other, "Poor fellow! what a pity he is crazy!"

About the time that Fitch was experimenting with his boat, attempts were also being made in Scotland by Miller, Taylor, and Symington.

After Fitch came Robert Fulton, first noticed through his steamer, the **Clermont**, on the Hudson, in 1807. This steamer was soon afterwards, in 1812, followed by Bell's **Comet**, the first on the Clyde, from which date it may be said that steam navigation became fairly launched, as from that time forth steamships began to be built of all kinds and descriptions. This little forerunner is reported to have been 42 feet long, 11 feet broad, and 5½ feet deep, and was fitted with two sets of paddle-wheels on each side, that is, four paddles in all, but this was soon abandoned for one wheel on each side, as the engine being only five-horse power could not work the two sets, but with the one set drove her at the rate of five knots in slack water and no wind.

The first steamer to face the open sea was named the **Phœnix**, and was built by Robert L. Stevens, at Hoboken, New Jersey, in 1808, then steamed round to Philadelphia,

and is reported to have behaved well; moderately rough weather was experienced off Cape May, at the entrance to the Delaware, but she did not remain in that trade, being afterwards employed only on the river.

The honour of being the first steam-vessel to cross the Atlantic rests with the **Savannah**, 130 feet long by 26 feet

SAVANNAH (1819). FIRST ATLANTIC STEAMER.

broad, and 16½ feet deep, which was built by Fickett and Crocker at Corlears Hook, New York. The keel was laid early in 1818 as that of an ordinary wooden sailing ship of about 320 tons. Before she was launched in August of the same year, a Captain Moses Rogers, who had already been sailing in the steamers on the rivers, and also navigated the **Phœnix** round to Philadelphia, induced a shipping firm in Savannah to buy her and fit machinery on board (described in detail in the chapter on Machinery, page

157). After this was completed a trial trip was made in New York Bay in March 1819, but with very moderate steam-pressure, namely 2 lbs. per square inch, whereas the actual pressure was 10 lbs. On Sunday, the 28th of the same month (March), she left New York for Savannah under sail. Owing to its blowing fresh the machinery was not used until April 2nd, when the wheels were shipped (that is connected on to the shafts, as they were kept on deck in bad weather) about 3 p.m., and the machinery worked until eight the next morning, when the sails were again set and the wheels taken off and stowed on deck. After this they were again used at intervals on the two following days, and Savannah was reached on April 6th. From there she proceeded to Charleston, where she had the honour of being visited by President Monroe of the United States, and then returned to Savannah, and sailed from there for Liverpool on Monday, May 24th, 1819, still under command of Moses Rogers. Both steam and sail were used for the first few hours, and at 8 a.m. the wheels were taken off and stowed in the space of twenty minutes. During the voyage the machinery was used at intervals, amounting altogether to eighty hours' continuous working, and the novelty of being a steamer caused her to be mistaken for a vessel on fire, not only by some merchant vessels, but also by H.M.S. **Kite**, which sighted her on June 17th off the south coast of Ireland, and boarded her to render assistance. Eventually she arrived at the mouth of the Mersey at 2 p.m. on Sunday, June 20th, 1819, and having shipped the wheels and stowed the sails, steamed up the river, and dropped anchor off Liverpool after a

passage of twenty-nine days eleven hours. The main cause of the machinery being used so little was due to the fact of the short supply of fuel, as she only had when leaving about 75 tons of coal and 25 cords of wood. Leaving Liverpool she proceeded to St. Petersburg, and eventually arrived back at Savannah on November 30th of the same year, but owing to heavy weather the machinery was not used until the pilot came on board.

After costing over £10,000 to purchase and fit out, she was sold in 1820 by the original owners, and the machinery taken out and sold to the Alliance Iron Works, New York. The vessel herself was then employed as a sailing ship between New York and Savannah until she came to an ignominious end by being wrecked on Long Island in 1822.

The next steamer to cross the Atlantic was the **Curaçoa**, in 1829, a vessel of 320 tons, which was built on the Clyde, and afterwards purchased by Dutch merchants, who put her on the West Indian trade from Antwerp, in which service she made only a few voyages.

The first vessel to steam all the way across the Atlantic was the first **Royal William** (probably named after the then reigning sovereign William IV.). This vessel was built of wood by James Goudie, of Scotland, at Quebec (not the Three Rivers as generally noted), in the shipyard of Black and Saxton Campbell, upon the lines of an early Clyde steamer, named the **United Kingdom**, built by Steele of Greenock in 1826 for the London and Leith service.

The dimensions of the **Royal William** were 176 feet over all, 146 B.P., 27 feet beam, 17·9 feet deep, and 830 tons gross.

The machinery had been made in England by Boulton and Watt on the side-lever principle, of 200 nominal horse-power, and was put into the ship by the St. Mary's Foundry, Montreal.

On April 29th, 1831, she was launched, and after completion commenced trading between Quebec and Halifax, N.S., and in this trade remained some time, but was sold during this period to another Company, which had as one of its directors Samuel Cunard, whose name was destined later on to be so well known on the Atlantic; but in this case there is no record of his having been one of the promoters of the scheme to send her across the ocean.

On August 4th, 1833, she left Quebec for London, and after calling at Pictou for coals, also at Cowes, Isle of Wight, arrived at Gravesend on September 11th, and on the passage experienced very heavy weather, sustaining damage to one of the paddle-wheels.

After remaining on the Thames for a few weeks, she proceeded to Bordeaux, and was then chartered by the Portuguese, but before the end of the year 1833 she was purchased by the Spanish Government, who changed the name to the **Ysabel Secunda**, as which she was the first steamship to fire a gun in action.

In June 1838, another **Royal William** was chartered from the City of Dublin Steam-packet Company, and despatched from Liverpool by the Transatlantic Steam-

ship Company to New York. She was built at Liverpool, by Wilson. The engines were made by the firm of Fawcett, Preston and Co., of the same place, and were side-levers of 400 indicated horse-power, having two cylinders 48½ inches diameter and 5½ feet stroke. The paddle-wheels were 44 feet diameter, and her speed was about eight knots an hour. This was the first real passenger steamer to cross the Atlantic, and also the first steamer to sail from Liverpool (on July 5th, 1838). She was the first to be divided into water-tight compartments by iron bulkheads, of which she had four. When in New York, on the first voyage, she was advertised for the homeward passage in the papers as follows—

"British Steamship, **Royal William**, 617 tons. Captain Swainson, R.N.R., Commander.

"This fine steamer, having lately arrived, will be despatched again to Liverpool on Saturday, August 4th, at 4 P.M. She is only sixteen months old, and from her peculiar construction (being divided into five sections, each water-tight) she is considered one of the safest boats to England.

"Her accommodations are capacious, and well arranged for comfort. The price of passage is fixed at 140 dols., for which wine and stores of all kinds will be furnished. Letters will be taken at the rate of 25 cents for the single sheet, and in proportion for larger ones, or one dollar per ounce weight. For further particulars apply to Abraham Bell and Co., or Jacob Harvey, 28, Pine Street."

After making a few passages across the Atlantic, she

was returned to her owners, in whose possession she remained as a coal-hulk until 1888, when she was sold for the sum of £11. Some idea of this vessel's size may be formed from the following table, giving her dimensions as compared with one of the powerful English tugboats of to-day—

Royal William, 145 feet by 27 feet broad, and 17½ feet deep, and 720 tons (400 horse-power).

Tugboat, 1899, 212 feet by 30 feet broad, and 15¼ feet deep, and 712 tons (1000 horse-power).

To take the place of the **Royal William**, the Transatlantic Steamship Company put upon the station the **Liverpool**, a steamer with 10-knot speed. The Company was announced by the following advertisement in the *Liverpool Mercury* of October 5th, 1838—

"TRANSATLANTIC STEAMSHIP COMPANY.

"Capital £800,000, in Shares of £100 each.

"The arrangement for establishing an intercourse by steam navigation between the British Isles and the United States of America being finally completed, and an union of interests in Liverpool being now satisfactorily arranged, the Directors of the Transatlantic Steamship Company have to announce that with the view of giving immediate effect to the operations, they have purchased the powerful and splendid steamship, the **Liverpool**, of 464 horse-power, by Messrs. George Forrester and Co., and 1150 tons burthen, built by Messrs. Humble and Milcrest for Sir John Tobin, and intended for Transatlantic intercourse.

"The Directors have also to state that for the purpose of securing an efficient and permanent establishment

between Liverpool and New York, two vessels are now building of 450 horse-power each, and 1250 tons burthen each, by Messrs. Fawcett, Preston and Co., and Messrs. W. and J. Wilson, and will, it is expected, be available in the course of next year.

"Shares in the first instance will be issued to the amount of but one half the capital above-mentioned.

"In issuing the remaining half, priority of subscription will be given to the then existing proprietors. Instalments to be called for at intervals of not less than three months, and not exceeding £10 per share.

"On allotment of shares a deposit of £5 per share to be lodged to the credit of Trustees with any of the Company's Bankers, who will give necessary receipt for the same.

"*Trustees.*—James Ferrier, Esq.; Richard Williams, Esq.; James Jameson, Esq.

"*Managing Directors.*—C. W. Williams, Esq., Liverpool; F. Carleton, Esq., Dublin.

"*Managing Committee in Liverpool.*—Harold Littledale, Esq.; Joseph C. Ewart, Esq.; Thomas Booth, Esq.

"*Bankers.*—Liverpool: The Royal Bank of Liverpool. Dublin: John David Latouche and Co. London: Glyn, Halifax, Mills and Co.

"*Solicitors.*—John North, Esq., Exchange Alley, Liverpool; P. D. Mahony, Trafalgar Square, London, and Dame Street, Dublin; J. C. Shaw, Superintendent of the Marine and Machinery Departments.

"Applications for the unappropriated shares may be made to the Company's Bankers or Solicitors or at the offices of the Company in Liverpool, Dublin, and London; or to D. and J. B. Neilson, Stock and Share Brokers, Exchange Street East, Liverpool.

"JOHN POLLOCK,
"Agent, 24, Water Street.

"Liverpool, September 15th, 1838."

As an instance of the great attention paid to the

earlier Atlantic steamers, the following account of this notable vessel, condensed from the *Liverpool Mercury* of October 12th, 1838, will be of interest—

"The **Liverpool** Steamship.

"As this vessel is not only the largest steamer hitherto built at this port, but the first that has been fitted up *à priori*, expressly for Transatlantic conveyance, much interest and curiosity have been excited by the appearance of so noble a specimen of the united skill of the naval architect and the engine-builder; and so numerous have been the visitors who have inspected her as the works approach towards completion, that some account of her dimensions and equipments may be acceptable to those of our readers who take an interest in the success already developed, and the high promise presented by the application of steam to the purposes of ocean navigation.

"The **Liverpool**, it is generally known, was built last year for Sir John Tobin by Messrs. Humble and Milcrest, and was purchased some months ago by the Liverpool Transatlantic Steam Company, an association branching out of the Dublin Steam Company, to whose enterprise and exertions for years Liverpool, as a port for steam vessels, is mainly indebted for its growing prosperity. Her length is 235 feet from stem to taffrail; her beam 35 feet (exclusive of the breadth of her paddle-boxes); the depth of hold is 21 feet; and she admeasures 1150 tons.

"The engines, built by Messrs. Forrester and Co., Vauxhall Foundry, are well worthy of inspection, both in regard to their compactness and beauty in construction, the extraordinary strength, and their superior finish. They are 468 horse-power. The cylinders are each 75 inches diameter, and the stroke of the piston-rod is 7 feet. The propelling force of these machines (enough to drive the

thousands of movements in ten or a dozen of our largest cotton-mills) will be prodigious.

"The iron shaft or spindle that turns the paddle-wheels is equal in girth to a man's body, and but fairly proportioned to the revolutionary force which the cranks will communicate.

"There are two distinct boilers, and two funnels, placed at some distance from each other, and ranging with the masts. The fire-rooms are spacious; the coals are supplied from lateral bunkers, made of plate iron; and large water-taps are at hand in case of danger from fire.

"The 'main or after cabin' is a splendid apartment of 58 feet in length, and 28 feet 9 inches in width at one end, slightly narrowing to 22 feet 4 inches at the stern; it is 8 feet in height to the beams, and 8½ feet between them. . . .

"The state-rooms are exceedingly handsome and commodious. There are in this cabin, sixteen in number, each with two berths or beds, with the exception of two, which are each fitted, for the peculiar accommodation of a party, with three beds. They are well lighted from the roofs and sides by patent lights, those in the sides serving also, on being opened, as ventilators.

"The colouring of these rooms is a warm, delicate pink, with gorgeous damask silk hangings to correspond, of French white, with crimson satin stripes. At the broadest or midship end of this main cabin is the ladies' retiring or private room, where several beds are also elegantly fitted up, and every convenience for the comfort and adornment of 'the fair' is provided. . . .

"There are tanks in abundance, in addition to which water will be daily and hourly distilled by an apparatus fixed for the purpose, and will undergo filtration, so as to be equal in purity and coolness to that of the 'crystal well' of the hermit. It may be added that in the main cabin, including the ladies' state-rooms, and the sofas, no fewer than fifty beds are provided.

"The 'fore cabin' is 45 feet in length, by from 29 feet 4 inches to 23 feet 10 inches in width, and has eight

THE SIRIUS (1838). THE FIRST BRITISH STEAMER TO CROSS THE ATLANTIC.

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dormitories or state-rooms on each side. This room is fitted in a style somewhat different to the other, but scarcely less beautiful or costly. The walls are empanelled in rosewood and other woods, with rich style, and separated by circular-topped pilasters."

She sailed from Liverpool on the 20th October, 1838, but put back to Queenstown (then called the "Cove of Cork") on the 30th October, sailing thence again on November 6th, and reaching New York on November 23rd. She made several voyages which averaged seventeen days out, and fifteen home; and was then sold to the Peninsular and Oriental Company, who changed her name to the **Great Liverpool**. She was afterwards wrecked off Cape Finisterre, on February 24th, 1846, with a loss of two lives.

It is, however, to the plucky little steamship **Sirius** (178 feet long, by 25½ feet broad, and 18¼ feet deep, of 703 tons) that belongs the real honour of commencing the great Atlantic ferry of to-day. This memorable little vessel was built by Menzies, of Leith, and was engined by Messrs. Wingate and Co., of Whiteinch, near Glasgow. The engines were on the side-lever principle, having cylinders 60 inches diameter and stroke of 6 feet, fitted with a surface condenser exactly similar to those now in use. The paddle-wheels were 24 feet diameter, and the steam pressure 15 lbs. A newly-formed company named the British and American Steam Navigation Company (the leading spirit of which was Mr. John Laird, afterwards M.P. for Birkenhead) chartered her from the St. George's Steam-packet Company, and despatched her from Queenstown for New York on April 5th, 1838, under the command of Lieutenant Richard Roberts, R.N., who was

afterwards lost in the ill-fated **President**, in 1841. Like the world-famous voyage of the great discoverer, Christopher Columbus, the first voyage of the **Sirius** was one only carried out to its end by the energy and determination of the commander; as shortly after leaving port, owing to continuous head-winds, the crew became mutinous, and declared it was utter madness to proceed in so small a vessel, she being not quite so large as the tugboats of to-day. However, thanks to stern discipline and the persuasive arguments of loaded firearms, the gallant little vessel arrived at New York on April 21st, after an eventful passage of 16½ days, during which she maintained an average speed of 8½ knots per hour on a consumption of about 24 tons of coal per day.[1]

A few hours after the arrival of the **Sirius**, another steamer, named the **Great Western**, owned by the Great Western Steam Navigation Company of Bristol, also arrived, having left Bristol on April 8th, 1838, thus making the passage in 13½ days. This "huge vessel," as she was then styled, was built at Bristol, by Patterson, and launched on July 19th, 1837, her dimensions being 212 feet long, by 35⅓ feet broad, by 23¼ feet deep, and 1340 tons. She was towed to London to have her engines put on board. The engines were built by Maudslay, Sons, and Field; they were of the side-lever type, having two cylinders 73½ inches diameter, and stroke of 7 feet, indicating 750 horse-power. The paddles were 28½ feet

[1] After this voyage she was returned to the owners and employed by them in the Irish Cross Channel Trade until January 1847, when she was wrecked near Queenstown.

THE GREAT WESTERN (1838).

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[From an old aquatint.] THE BRITISH QUEEN (1839). (The "President," 1840, was identical in build.) [To face page 15.

diameter, and the revolutions about fifteen per minute. Steam was generated in four iron return-flue boilers carrying 15 lbs. pressure, and the daily consumption was about 33 tons. The average duration of the passages by the **Great Western** between Bristol and New York was 15 days, the fastest being about 13⅓ days, and the average speed being about 8½ knots per hour. In 1843 she was put on the Liverpool to New York route, and there maintained a higher speed, on one voyage having actually steamed ten knots all the way.

The **Sirius** having encouraged the British and American Steam Navigation Company, which was formed by MacGregor Laird in 1837, with a capital of £1,000,000 in £100 shares, to dispatch a steamer to New York every fortnight alternately from London, and Liverpool; they brought out first the **British Queen** in 1839, and next the **President** in 1840.

Both these vessels were built by Curling and Young, on the Thames, of wood, and were 275 feet long, 37½ feet broad, and 27 feet deep, and of 1863 tons gross register, with square sterns, and one funnel painted white with black top.

The engines of the **British Queen** were of the side-lever type, and were supplied by Napier on the Clyde, with cylinders 71½ inches diameter, and 7 feet stroke of 700 indicated horse-power, fitted with the great novelty of a surface condenser; the paddle-wheels were 30 feet diameter.

The engines of the **President** were slightly more powerful, having cylinders 81 inches diameter, and 7½ feet stroke, and were supplied by Fawcett-Preston of Liverpool.

The first sailing was the **British Queen** from Portsmouth, on July 12th, 1839, followed by the **President** from Liverpool on July 17th, 1840; these sailings did not, however, last long, as the **President** was never heard of after sailing from New York on March 11th, 1841, with a small number of passengers. In consequence of this disaster the Company ceased to exist, and the **British Queen** was sold to the Belgians in 1841.

Through the courtesy of the late Colonel W. E. Roberts, of Liverpool, nephew of Lieutenant Roberts, a fac-simile of an interesting letter, written by him when in command of the **British Queen**, is appended, and is an interesting souvenir owing to the statement he therein makes that he would not retire until he had command of the first iron vessel to cross the Atlantic; his indignation about the reflection on the speed of his vessel, as compared with the **Great Western**, is also noteworthy, as showing the rivalry existing even then.

Having now briefly enumerated the earliest vessels which were produced to create the first Transatlantic lines, it will perhaps be convenient to here notice another of the earlier steamships, the venerable **Great Britain**. This, the first iron steamer of large size, was 274 feet long, 48¼ feet broad, and 31½ feet deep, and of 3270 tons, and was built at Bristol, by Patterson, for the Great Western Steamship Company, fitted with engines made by them from designs by Guppy. There were four diagonal cylinders, each 88 inches diameter, 72 inches stroke, indicating 1500 horse-power, and burning 65 tons per day, working upwards on the crank-shaft, from which

Steam Ship British Queen
New York 1 June 1840

My dear Norcott

I just saw a letter from you to Saltofields and I felt greatly surprised and having one line as you must have been perfectly aware so large a property as B Queen could not remain idle. ~~[illegible]~~

I am very glad to find you all well in health. Mr ——— appears greatly surprised not getting a letter also— he often spends a few hours with Jane as I suppose you are aware. She came out with me and remains till first of August. I have great hopes of seeing you this trip but hope to meet next time as I understand you purpose going to Europe by New York how glad I shall be

if you will take a passage in the
Cobble Ship? I have the Honour to Commence
tho' you think otherwise I can only state
there is not a faster Seagoing Steam
vessel in the <u>World</u> and time will
tell we have beat Great Western every
voyage this year, and equal last year
therefore whoever gave you the idea
of our Speed and Powers were perfectly
ignorant of Steamers and <u>Steam vessels!</u>

Staines

made the Passage from Portsmouth to Newyork shorter than ever performed as only 13d 11h from Pilot to Pilot. let Great Western do that if she can this she has ten hours shorter distance to run -

Sail at 1 PM this day with full Cargo and every berth taken and sincerely do I wish to make a short passage I intend trying for some Shore berth as Jane does not like my going to sea but will not -

became till I came in the first Iron Vessel
to steam across the Atlantic

Sister William all my uncle any they in
shore better than afloat after 21 years
time to have quiet. William wants to have
a home also.

Have my Child
and Nurse with Jane given by God bless

Ever and
Your Ever Affectionate
Brother Richd Roberts

motion was brought down to the screw-shaft by means of four endless chains. The propeller was six-bladed, of widely different form from that now in use; the pitch was about 25 feet, and the diameter 15½ feet. Steam at 25 lbs. pressure was generated in three doubled-ended boilers, fired fore and aft, but without the present system of tubes. Each boiler was 34 feet long, 10 feet wide, and 24 feet high, and had eight furnaces, each 7 feet 6 inches long, by 1 foot 11 inches wide. These engines were found to be defective, and were replaced in 1852 by geared oscillating engines made by Penn of Greenwich, having oscillating cylinders 82½ inches diameter and 6 feet stroke. The career of this wonderful craft was a varied and chequered one; launched on July 19th, 1843, she was detained in the Cumberland dock until December 12th, 1844, owing to the gates being too narrow to allow her to pass out. The fact of the gates being too narrow was clearly known to the owners, but when the vessel was first talked of, the Port Authorities then arranged to widen the dock entrance, and as the work was not carried out expeditiously, she was detained a prisoner.

On July 26th, 1845, she sailed on her first voyage from Liverpool for New York, and continued on that station until September 1846, when she was stranded on Rathmullin Point, County Down, Ireland, where she remained intact for a whole winter, thus early proving the great strength of iron vessels. In 1853 she was entirely refitted with new masts and engines, and placed upon the Liverpool and Australian trade, in which she was fairly successful until 1874, when she was withdrawn. In 1882

THE GREAT BRITAIN AS ORIGINALLY RIGGED (1843).

[To face page 22.

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THE GREAT BRITAIN (*as altered*). 1853.

[*To face page* 23.

she again underwent a complete change, being altered to a full-rigged sailing vessel, as which she only ploughed the waters of the sea for a brief period; having put into the Falkland Islands leaking, she was condemned, and has remained there as a hulk. One valuable invention which sprung from the early negotiations about this vessel was the steam-hammer, which arose through the then great difficulty of forging iron shafts large enough for the paddle engines, which it was first arranged by Brunel were to be fitted. In his difficulty Brunel consulted Nasmyth of Patricroft, Lancashire, who, after considerable labour and trouble, eventually succeeded in producing the now well-known steam-hammer.

In concluding this early history it only remains to just notice the oft-quoted saying of Dr. Lardner,[1] and we come

[1] This noted saying is again and again repeated to the discredit of the eminent scientist, and there is no question but that he distinctly stated it as generally reported, namely, "that as to the project which was announced in the newspapers of making the voyage directly from New York to Liverpool, it was, he had no hesitation in saying, perfectly chimerical, and they might as well talk of making a voyage from New York to the moon." This announcement was published in the *Liverpool Albion* of December 14th, 1835, and was based upon the assumption that the maximum size of the vessels would be 800 tons and have 200 horse-power, but the fallacy of this reasoning was upset by a letter in reply from Macgregor Laird, which appeared in the same paper of the 28th December of the same year. In view of the fact that the first **Royal William** had but two years previously (see page 7) steamed all the way across the Atlantic, it is difficult to realize that Dr. Lardner actually meant what the wording of the statement clearly denotes, but be the reasons what they may, there is no question but that he put forth the statement. It may have been that in his zeal to further the adoption of an Irish port of departure for such a service, he allowed himself to be

to the foundation of the great regular lines which to-day bridge the wild and tempestuous Atlantic with swift, silent messengers of peace and plenty.

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carried away by theoretical calculations and data which were then being rapidly upset by actual practice, and which, fortunately for the world at large, proved commercially successful.

CHAPTER II.

THE CUNARD LINE.

THE foundation of the modern Transatlantic lines—which should rank as one of the great stepping-stones of an exceptionally eventful age—had but a modest origin. It was conceived by a gentleman bearing a name well known and honoured wherever a steamship floats, namely, Mr. Samuel Cunard.[1] This famous gentleman—whose likeness is to be found on page 200—was of Canadian birth and origin. Early perceiving the advantages possessed by steamers over sailing vessels for regularity, Mr. Cunard came to England in 1839, and together with two of the ablest shipping men then existing in Great Britain, Mr. George Burns of Glasgow, and Mr. David MacIver of Liverpool, entered into an agreement with the British Government (owing to the earlier vessels already noted being withdrawn) to commence a fortnightly in summer and in winter monthly Transatlantic mail steamship service, from Liverpool to Halifax and Boston, for an annual subsidy of £81,000 per annum. To carry on this trade four steamers, the **Britannia** (launched February 5th, 1840), **Acadia**, **Columbia**, and **Caledonia**, were built of wood by Robert Duncan and Co., and others, at Port Glasgow, each being

[1] Afterwards Sir Samuel Cunard.

207 feet long, by 34½ feet broad, and 22½ feet deep, and of 1150 tons. The engines were of the side-lever type, having two cylinders, each 72½ inches diameter and 82 inches stroke, working up to about 740 indicated horse-power, and driving-paddles 28½ feet diameter, which gave an average speed of 8¼ knots per hour. The boilers were of the return-flue type, four in number, with twelve furnaces working at 12 lbs. pressure, and having a consumption of about 38 tons per twenty-four hours. The whole of the machinery was made and fitted by Mr. Robert Napier, a name destined afterwards to become famous in the maritime engineering world. The commencement of this line was announced by the following advertisement in the *Liverpool Mercury*, July 3rd, 1840—

"British and North American Royal Mail Steamships of 1200 tons and 440 horse-power each.

"Appointed by the Admiralty to sail for Boston, calling at Halifax to land passengers and her Majesty's mails:

Britannia, Captain Woodruff.
Acadia, Captain Edward C. Miller.
Caledonia, Captain Richard Cleland.
Columbia.

"The **Britannia** will sail from Liverpool on the 4th July; the **Acadia** on the 4th August.

"Passage, including provisions and wine, to Halifax, 34 guineas; to Boston, 38 guineas. Steward's fee, 1 guinea.

"The steamship **Unicorn** plies between Pictou and Quebec, in connection with the above vessels, carrying the mails and passengers.

"For passage, apply to G. and J. Burns, Glasgow; J. B. Foord, 52, Old Broad Street, London; or in Liverpool to D. and C. MacIver, 12, Water Street.

"The **Britannia** goes out of the Coburg Dock this

THE BRITANNIA (1840). FIRST STEAMER OF THE CUNARD LINE.

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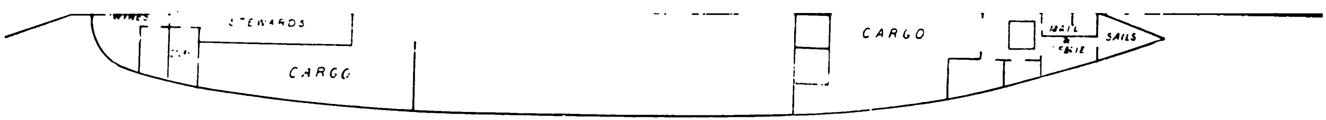


SECTION AND DECK PLANS OF THE BRITANNIA (CUNARD STEAMER).

[To face page 27.

morning (Friday), the 3rd inst., and all heavy luggage should be sent on board before that time. To-morrow (Saturday morning) at ten o'clock, a steamer will be at the Egremont Slip, south end of Prince's Dock, to take off the passengers."

The great importance of these early mail steamers is clearly shown by the successful attempts made by the people of Boston to release her from the ice, which is described in the following extract from the *Liverpool Albion.* The illustration is taken from an old print issued by the people of Boston to commemorate the event.

"*Release of the* **Britannia** *from the Ice at Boston.*—Looking into the windows of a print-shop, I saw an engraving of our good ship the **Britannia**, which we had just quitted, represented as in the act of forcing her way through the ice of Boston harbour in the winter of 1844, a truly Arctic scene. A fellow-passenger, a merchant from New York, where they are jealous of the monopoly hitherto enjoyed by their New England rival, of a direct and regular steam communication with Europe, remarked to me that, if the people of Boston had been wise, they would never have encouraged the publication of this print, as it was a clear proof that the British Government should rather have selected New York, where the sea never freezes, as the fittest port for the mail-packets. I had heard much during the voyage of this strange adventure of the **Britannia** in the ice. Last winter it appears there had been a frost of unusual intensity, such as had not been known for more than half a century, which caused the sea to be frozen over in the harbour of Boston, although the water is as salt there as in mid-ocean. Moreover, the tide runs there at the rate of four or five miles an hour, rising twelve feet, and causing the whole body of the ice to be uplifted and let down again to that amount twice every

twenty-four hours. Notwithstanding this movement, the surface remained even and unbroken, except along the shore, where it cracked. Had the continuance of this frost been anticipated, it would have been easy to keep open a passage; but on February 1st, when the **Britannia** was appointed to sail, it was found that the ice was 7 feet thick in the wharf, and 2 feet thick for a distance of seven

BRITANNIA IN ICE AT BOSTON, 1844.

miles out; so that waggons and carts were conveying cotton and other freights from the shore to the edge of the ice, where ships were taking in their cargoes. No sooner was it understood that the mail was imprisoned, than the public spirit of the whole city was roused, and a large sum of money instantly subscribed for cutting a canal, seven miles long and 100 feet wide, through the ice. They began the operation by making two straight furrows, 7 inches deep, with an ice-plough drawn by horse, and then sawed the ice into sheets, each 100 feet square. When

these were detached, they were made to slide, by means of iron hooks and ropes fixed to them, under the great body of the ice, one edge being first depressed, and the ropes being pulled by a team of horses, and occasionally by a body of fifty men. On February 3rd, only two days after her time, the steamer sailed out, breaking through a newly-formed sheet of ice, 2 inches thick, her bows being fortified with iron to protect her copper sheathing. She burst through the ice at the rate of seven miles an hour without much damage to her paddles; but before she was in clear water all her guard of iron had been torn off. An eye-witness to the scene told me that tents had been pitched on the ice, then covered by a slight fall of snow, and a concourse of people followed and cheered for the first mile, some in sleighs, others in sailing-boats fitted up with long blades of iron, like skates, by means of which they are urged rapidly along by their sails, not only before the wind, but even with a side wind, tacking and beating to windward as if they were in the water. The **Britannia**, released from her bonds, reached Liverpool in fifteen days, so that no alarm had been occasioned by the delay; and when the British Post Office department offered to defray the expense of the ice-channel, the citizens of Boston declined to be re-imbursed."—LYELL'S *Second Visit to the United States of North America.*[1]

The following notices from the *Liverpool Albion,* Feb. 18th, 1850, will also serve to show the great interest taken in the Cunard vessels, and also the duration of passages then prevailing—

"*The Halifax Steam Squadron.*—As the British and North American Royal Mail Company's magnificent fleet stands pre-eminent among ocean steamers, the following tabular statements of their performances for the past year (1849) will be found interesting. The first shows the time taken by each vessel on her *homeward* passage, including the deviation to, and detention at, Halifax—

[1] London, 1849.

Names.	Port.	Sailed.		Arrived.		Time. Days.	Hours.
Europa	New York	Jan.	10	Jan.	22	11	18
America	Boston	,,	24	Feb.	4	11	3
Canada	New York	Feb.	7	,,	19	12	4
Niagara	Boston	,,	21	March	6	13	0
Europa	New York	March	7	,,	20	12	16
America	Boston	,,	21	April	3	12	7
Canada	New York	April	4	,,	19	14	12
Niagara	Boston	,,	18	,,	30	11	12
Europa	New York	May	2	May	14	12	3
Cambria	Boston	,,	9	,,	24	12	7
America	New York	,,	16	,,	28	11	12
Hibernia	Boston	,,	23	June	4	12	6
Canada	New York	,,	30	,,	12	12	10
Caledonia	Boston	June	6	,,	18	11	19
Niagara	New York	,,	13	,,	25	11	9
Europa	Boston	,,	20	July	1	10	14
Cambria	New York	,,	27	,,	10	13	0
America	Boston	July	4	,,	15	11	0
Hibernia	New York	,,	11	,,	24	12	10
Canada	Boston	,,	18	,,	28	9	22
Niagara	New York	,,	25	Aug.	6	12	4
Caledonia	Boston	Aug.	1	,,	14	12	18
Europa	New York	,,	8	,,	20	11	17
Cambria	Boston	,,	15	,,	26	11	2
America	New York	,,	22	Sept.	3	11	10
Hibernia [1]	Boston	,,	29	—		—	—
Canada	New York	Sept.	5	Sept.	17	12	0
Caledonia	Boston	,,	12	,,	25	12	18
Niagara	New York	,,	19	Oct.	2	13	6
Europa	Boston	,,	26	,,	7	10	8
Hibernia [2]	New York	,,	29	,,	13	14	0
Cambria	New York	Oct.	3	,,	18	14	11
America	Boston	,,	10	,,	21	11	6
Canada	New York	,,	17	,,	28	11	0
Caledonia	Boston	,,	24	Nov.	6	12	9
Niagara [3]	New York	,,	31	,,	13	12	17
Europa	Boston	Nov.	7	,,	18	11	12
Hibernia	New York	,,	14	,,	28	13	16
Cambria	Boston	,,	21	Dec.	3	11	14
America	New York	,,	28	,,	12	13	16
Caledonia	Boston	Dec.	5	,,	19	12	18
Canada	New York	,,	12	,,	24	11	22
Europa	Boston	,,	19	,,	30	11	3
Hibernia	New York	,,	26	Jan.	8	13	8

[1] Struck off Halifax and returned to New York.
[2] Did not call at Halifax.
[3] Had only one engine working.

"We extract from a New York contemporary the following table of the *outward* voyages of British mail steamships during the past year—

"'Annexed is a table, exhibiting the date of arrival, length of passage, number of passengers, with the day of departure, etc., of each steamer between New York and Liverpool during the past year; also one showing the time of arrival, passengers, etc., at Boston during the same period—

Names.	Arrival.	Passage.	Passengers from Liverpool.	Passengers from Halifax.	Day of Departure.	Passengers to Liverpool.	Passengers to Halifax.
Canada .	Jan. 29	16	50	7	Feb. 7	38	10
Europa .	Feb. 24	13¾	86	—	Mar. 7	71	3
Canada .	Mar. 25	14½	88	20	April 4	138	5
Europa .	April 19	12¼	82	7	May 2	129	—
America .	May 5	14¼	71	4	,, 16	118	11
Canada .	,, 17	11½	71	3	,, 31	139	6
Niagara .	June 2	13½	65	5	June 13	115	11
Cambria .	,, 15	13¼	61	3	,, 27	94	—
Hibernia .	,, 29	13¼	95	2	July 11	63	10
Niagara .	July 14	14	83	—	,, 25	92	12
Europa .	,, 27	12¾	123	—	Aug. 8	87	6
America .	Aug. 9	12	92	8	,, 22	94	3
Canada .	,, 25	13½	125	3	Sept. 5	84	7
Niagara	Sept. 7	13	127	8	,, 19	48	—
Cambria .	,, 22	13¾	71	11	Oct. 3	51	5
Canada .	Oct. 4	12	72	1	,, 17	72	4
Niagara .	,, 19	13¼	148	—	,, 31	14	5
Hibernia .	Nov. 5	16	85	6	Nov. 14	48	9
America .	,, 18	14	84	3	,, 28	76	3
Canada .	Dec. 1	13½	46	13	Dec. 12	78	2
Hibernia .	,, 18	17	69	6	,, 26	36	5

"'The average passages to this port from Liverpool were made in 13 days and 16 hours.

"'The table given on page 26 exhibits the time of arrival, etc., at Boston.

"'The average passage to Boston from Liverpool is 12 days and 22 hours.

"'The **Canada** made the shortest passage to this port,

Names.	Arrival.		Passage.	Passengers from Liverpool.	Passengers from Halifax.	Day of Departure.		Passengers to Liverpool.	Passengers to Halifax.
America .	Jan.	12	13	53	7	Jan.	24	49	2
Niagara .	Feb.	11	15	50	7	Feb.	21	54	8
America .	Mar.	9	13	80	17	Mar.	21	88	14
Niagara .	April	7	14	43	24	April	18	110	11
Cambria .	,,	27	13	41	10	May	9	77	12
Hibernia .	May	12	$13\frac{1}{2}$	52	12	,,	23	35	3
Caledonia .	,,	26	$13\frac{1}{2}$	38	6	June	6	44	5
Europa .	June	7	$11\frac{1}{2}$	53	—	,,	20	105	7
America .	,,	21	$10\frac{2}{3}$	57	8	July	4	83	5
Canada .	July	4	$11\frac{1}{4}$	84	10	,,	18	126	12
Caledonia .	,,	20	$13\frac{3}{4}$	45	—	Aug.	1	38	9
Cambria .	Aug.	3	13	57	6	,,	15	28	4
Hibernia[1] .	,,	16	$11\frac{1}{2}$	68	4	,,	29	26	19
Caledonia .	,,	31	13	65	18	Sept.	12	18	4
Europa .	Sept.	12	$10\frac{2}{3}$	114	18	,,	26	50	8
America .	,,	27	$11\frac{3}{4}$	83	6	Oct.	10	84	10
Caledonia .	Oct.	12	$12\frac{1}{2}$	83	13	,,	24	17	16
Europa .	,,	25	$12\frac{1}{2}$	123	15	Nov.	7	76	7
Cambria .	Nov.	10	$13\frac{3}{4}$	86	5	,,	21	38	3
Caledonia .	,,	24	$14\frac{1}{2}$	14	6	Dec.	5	20	5
Europa .	Dec.	9	$14\frac{3}{4}$	52	4	,,	19	16	7
Cambria .	,,	29	$14\frac{1}{2}$	82	—	Jan.	9	—	—

and the **Hibernia** the longest. The **America** and **Europa** made the shortest to Boston, and the **Niagara** the longest.' "

Although not afterwards employed as an Atlantic liner, a steamer named the **Unicorn** was really the first vessel to be sent across the Atlantic by the Cunard Line; she left Liverpool for Halifax and Boston, on May 16th, 1840, and arrived at Boston on June 3rd. This vessel was then placed on the service between Pictou and Quebec in the summer, and remained there until 1846. The Atlantic Service of this now justly famed line was commenced

[1] The **Hibernia** on this trip sprung a leak, and returned to Halifax and left her passengers and mails; then came to New York for repairs, and sailed on the 29th September for Liverpool direct, with nineteen passengers.

on July 4th, 1840, when the **Britannia** first sailed from the Mersey for Halifax and Boston, carrying the British mail, and arrived at the latter port on the 19th, having made the passage in 14 days 8 hours, including a stop of several hours at Halifax. Since this event to the present time the regular sailings of the steamers of this line have been kept up without interruption, though special efforts have sometimes been required. As the gradual expansion of the trade took place, other steamers were built and put upon the station; namely, in 1843 the **Hibernia**, and in 1845 the **Cambria** of 1040 horse-power, 1422 tons and $9\frac{1}{4}$ knots, were added; in 1848 the **America**, **Niagara**, **Canada**, and **Europa** of 1820 tons, 1400 indicated horse-power, and $10\frac{1}{4}$ knots; in 1850 the **Asia** and **Africa**, of 2227 tons, and 2000 indicated horse-power, and steaming 12·3 knots per hour. In this and preceding year, the three original vessels were sold, excepting the **Columbia**, which had been wrecked in 1843. Following after these came the **Arabia** in 1852, which was the last wooden vessel built for the Cunard fleet; she was 285 feet long, 40·8 broad by 27·7 deep, and of 2393 tons, the indicated horse-power was 2900, and speed 12 knots.

Each of these succeeding vessels was built of improved design, as experience pointed out, but with no radical departures from the **Britannia** until the year 1856, when the **Persia**, the first iron paddle-steamer owned by this line, was put upon the station to maintain the supremacy which was now being contested by other lines.

Another extract is worth printing as showing the financial working of steam shipping about fifty years ago—

D

"*The British and North American Royal Mail Company.*—The following particulars respecting the Cunard steam fleet will be found interesting, as showing how the company maintained the service in 1850—**Arabia**, building, 950 horse-power and 2500 tons (lately sold to the West India Royal Mail Company); **Persia**,[1] building, 950 horse-power and 2500 tons; **Asia**, 800 horse-power and 2226 tons; **Africa**, 800 horse-power and 2226 tons; **America**, 650 horse-power and 1826 tons; **Canada**, 650 horse-power and 1831 tons; **Europa**, 650 horse-power and 1834 tons; **Niagara**, 650 horse-power and 1824 tons; **Cambria**, 1423 tons. But, besides these, there are some subsidiary lines which require to be mentioned. Thus, there are two steamers, the **Admiral**, of 929 tons and 388 horse-power, and the **Commodore**, of 800 tons and 350 horse-power, which maintain a communication between Liverpool and Havre; and two vessels, the **Camilla**, of 529 tons and 220 horse-power, and the **Lyra**, 543 tons and 275 horse-power, which maintain a communication between Liverpool and Glasgow. The **Margaret**, also, a vessel of 700 tons and 310 horse-power, and the **Laurel**, a vessel of 428 tons and 180 horse-power, are sometimes employed upon these subsidiary lines, though, commonly, the **Margaret** plies between Liverpool and the Mediterranean, and the **Laurel** plies between Belfast and Glasgow. Thus this great enterprise was (1851) maintained by a fleet of steamers, the power of which is 6100 horse for the main line, and 1723 horse for the feeding and subsidiary lines. The subsidy which the enterprise receives from the British Government is, therefore, at the rate of nearly £24 per annum per horse-power upon the whole fleet, feeders and subsidiary lines inclusive. No official or authorized statement has been published of the financial condition of the Cunard Company. Its proprietors are limited in number, and generally to large capitalists, who arrange their interests

[1] This name was changed to **Arabia** before launching, owing to the sale of the **Arabia** first noted; the Cunard Line only had one steamer named the **Persia**, the famous iron one noted (page 35).

THE CUNARD STEAMSHIPS PERSIA (1856) AND SCOTIA (1862), THE LAST PADDLE-WHEEL ATLANTIC STEAMER. [*To face page* 35.

in private meetings, the results of which are not made public. To estimate the amount of the capital, let the value of the ships be taken, in round numbers, at £120 per horse-power. Thus, for 7823 horse-power, we should have a capital of £936,760. To this must be added the furniture, plate, etc., of the ships, the offices, warehouses, stations, etc., at the several ports with which they communicate, the capital engrossed by which, added to the amount just stated, will make a total which cannot fall short of £1,500,000. It follows, therefore, that this company, after having defrayed its current expenses, must have a balance of about £375,000 before it can begin to enjoy any net profit; for it has resulted from the general experience of England, both by Government and commercial companies, that besides the current expenses of working a line of steamers, it is necessary to carry yearly to the account of the capital, to cover interest, sinking fund, insurance, etc., a sum equal to 25 per cent. of the total capital involved." —*Liverpool Albion*, February 2, 1852.

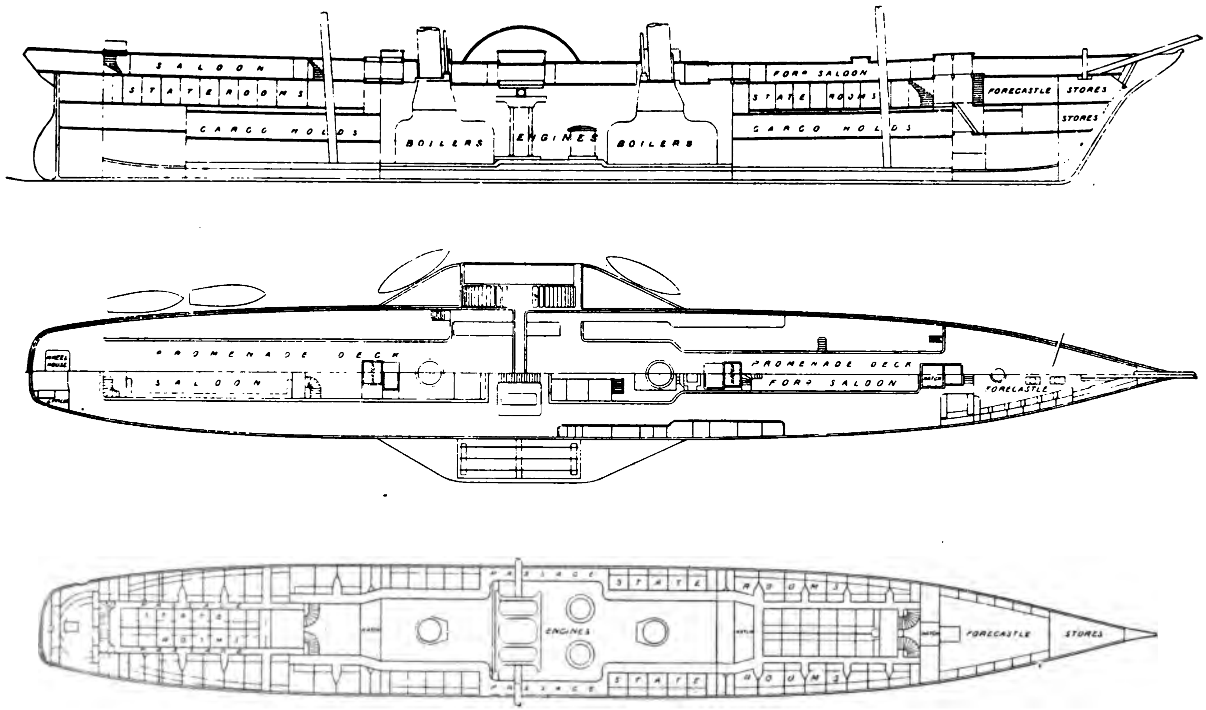
Owing to the fact of her being constructed of iron, and having made the fastest passages (see Table 2), the **Persia** became one of the most famous vessels that ever existed on the Ferry; she was 360 feet long, by 45·3 feet broad, and 29·9 feet deep, of 3300 tons, the speed being 12½ knots per hour. Both ship and engines were constructed by Messrs. Robert Napier and Sons, Glasgow, the latter being of the "side-lever" type, with two cylinders each 100½ inches diameter and 10 feet stroke, and indicated 3600 horse-power.

The paddle-wheels were 40 feet diameter; the boilers were eight in number, having forty furnaces, the steam-pressure carried was 20 lbs., and the consumption of coal reached 150 tons per day.

The last paddle-vessel, the **Scotia**, which was also built of iron, and engined by R. Napier and Sons, came out in 1862, and was 379 feet long, 47·8 feet broad, and 30·5 feet deep, of 3871 tons, and speed of 13½ knots, the engines being of the same type, with cylinders 100 inches diameter and 12 feet stroke, indicating 4000 horse-power on a daily consumption of 165 tons.

No efforts were spared to render these the crack boats in the service, and with very satisfactory results, as the rates of passage-money were raised for these boats, and a sort of express service for passengers was then practically first introduced across the Atlantic.

Owing to the superiority of the screw-propeller being by this time admitted, these two noble vessels proved to be the last of the ocean-going paddle-wheel type, and were sold; the **Persia** in 1868 to be converted into a sailing ship, and the **Scotia**, which sailed from Liverpool on her last voyage in September 1875, to the Telegraph Construction and Maintenance Company, who converted her into a twin-screw steamer for telegraph-cable purposes, as which she still exists. After sailing to and from Boston until 1848, this line commenced another service to New York with some new vessels just added to its fleet; this advance was induced no doubt by the fact of a coming American rival sailing from that port—the Collins Line, noticed later. From this year New York became the chief port, although a service was maintained to Boston until 1868, when it was given up, but was again resumed in 1870 and has been kept up ever since.



GENERAL ARRANGEMENT OF S.S. PERSIA (1856). CUNARD LINE.

[To face page 36.

Concerning the invention of the screw-propeller, this, like most other matters connected with early engineering, is much disputed, the credit being claimed for Mr. Edward Shorter, of Southwark, who is reported to have taken out a patent for it, and tried it in 1802 on H.M.S. **Doncaster**, working it by means of an ordinary capstan with gearing; other names mentioned as the inventors are Robert Hooke, David Bushnell, and Frederic Sauvage, a Frenchman; but to Mr. F. P. Smith must be given the credit of first having made it successful. Having obtained his patent in 1836, he had it tried on a small vessel named the **Archimedes**, which was built by Henry Wimshurst, who also claims to have had a share in working out the screw-propeller. This little vessel was first tried on the Thames in 1839, and obtained a speed of 8½ miles. Afterwards it was improved upon by Mr. Bennet Woodcroft and Mr. Robert Griffiths, the latter being the introducer of the form now in general use.

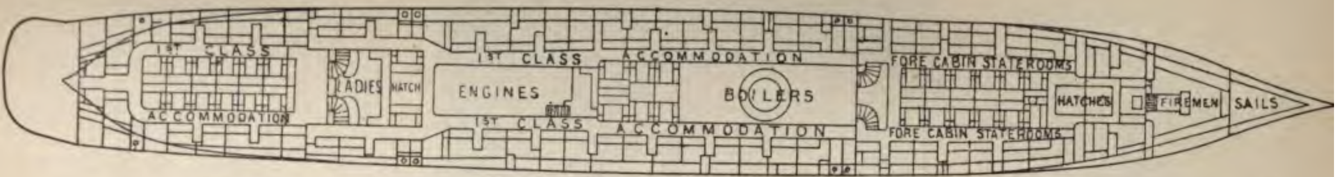
The Cunard Line had so early as 1851 iron screw-steamers built by Denny of Dumbarton named the **Australian** and **Sydney**, boats 216 feet long, by 34 broad, and 25 feet deep, which were sold before taken over and were followed by the **Alps**, **Andes**, and other iron vessels 241 feet long, by 34 broad, and 25 deep, fitted with beam-geared engines having cylinders 62 inches diameter, and 4 feet 6 inches stroke, of 1000 I.H.P. (see illustration, page 166), which were employed in the French and Mediterranean branch of the service, (the latter commenced in 1853,) and occasionally on the Boston Line, but it was not until 1861 they ventured to build an iron screw for their New York Mail Service. This vessel was named the **China**, and was put on the

station in 1862, her dimensions being 326 feet long, by 40½ broad, and 27½ deep. She was built by Messrs. Napier and Sons at Glasgow, as were the engines, which were surface-condensing, and of a type then in vogue; these consisted of two oscillating cylinders (each 80¼ inches diameter, and 5 feet 6 inches stroke) working upwards, and

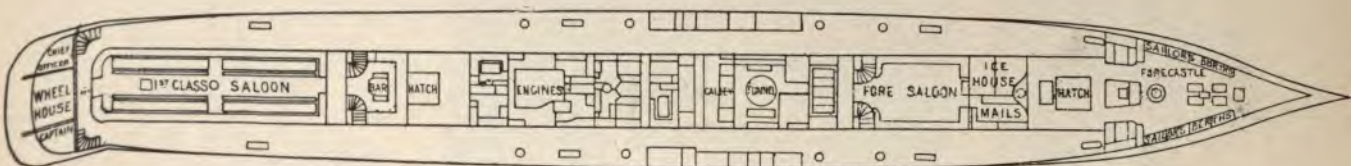
THE CUNARD STEAMER CHINA (1861).

being geared down to the propeller shaft by ordinary tooth gearing. The pressure carried was 25 lbs., and her average speed was about 12 knots.

Another famous screw-steamer brought out by this company was the **Russia**, which was put on the service in 1867. She was of slightly larger dimensions than the **China**, being 358 feet long, by 43 feet broad, and 29 feet deep, and 2959 tons. She was propelled by inverted direct-acting engines, having two cylinders, each 87 inches



Middle Deck.



Main Deck, showing arrangement with a long wooden deckhouse and high bulwarks.

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DECK PLAN OF S.S. CHINA.

diameter, and 45 inches stroke. The vessel and engines were built by Messrs. J. and G. Thomson. She carried on the express service of the Cunard Company for a few years with the **Scotia**, but the honour of the fastest passage having been wrested from this line soon after she came out, she did not become noted for high speed, although she continued to

THE CUNARD STEAMSHIP RUSSIA (1867).

be patronized by the majority of the saloon passengers. In 1881 she was sold to the Red Star Line of Antwerp, and by them lengthened and fitted with compound engines, and re-named the **Waesland**; and still continues to "bridge the ocean," having in 1890 been re-fitted with triple engines. At the present time (1899) this noted vessel bears the honour of being the oldest craft engaged upon the Atlantic Ferry,

and, rather strangely to relate, trades from the original home port, Liverpool, to which she returned in 1895, to take up the Philadelphia service of the American Line, but not under the old Flag, as the Belgian ensign has taken its place. The **Palestine**, noted in the first and the popular editions, has now disappeared, having been sold to the shipbreaker in March 1896.

After the **Russia**, the Cunard Company still continued to add new iron screw-propelled vessels to their fleet; but none of them became prominent, as they were rather behind the time in design and arrangements of hull and machinery, and in passenger accommodation. Their first vessel with compound engines was the **Parthia**, brought out in 1870, followed in the same year by the **Algeria** and **Abyssinia**, which had ordinary expansion vertical engines. In 1874 came the **Bothnia** and **Scythia**, fitted with compound engines (the latter becoming noted owing to a large whale striking the propeller in July 1875), and were followed in 1879 by the **Gallia**,[1] fitted with three-crank compound engines, and in 1881 by the **Servia**. This huge vessel, like the other Cunarders about this period, was built and engined by J. and G. Thomson, of Clydebank. She was 515 feet long, 52 broad, 38 deep, and 7392 tons; the engines were of the ordinary compound vertical three-crank type, the high-pressure cylinder in the centre being of 72 inches diameter, and each of the low-pressure 100 inches, with a stroke of 6 feet 6 inches.

The **Servia** was practically the first of what may be

[1] Sold for the Canadian Service of D. and C. MacIver in the autumn of 1897.

called the Express Transatlantic Service, as, owing to the immense space required for the powerful machinery necessary for the high speed beginning to prevail, but little room was left for cargo. Another reason for the greater attention given to passenger traffic was the large number of slow, small-powered, big-carrying modern cargo-boats commonly called "tramps," which were flooding the freight market with tonnage and so cutting down rates.

Although the first steel vessel, and the first with a cellular bottom in the Express Service, the **Servia** was not the first in the North Atlantic trade, that honour belonging to the Allan Liner **Buenos Ayrean**, built and engined by Denny of Dumbarton, in 1879, and the **Parisian**, built by Napier in 1881. In 1882 another Cunarder, the steel **Aurania**, also built by J. and G. Thomson, came out, and represented a new departure suggested by the builders, which was, in fact, a reaction against the then prevailing proportions of length to beam, which was generally 10 or 11 to 1. In this craft these proportions were altered to about 8 to 1, the dimensions being 470 feet long, 57·2 feet broad, 37¼ feet deep, and 7270 tons. The engines were of the same design as the **Servia's**, but slightly less powerful.

Neither of these vessels attained the honour of the much-prized "fastest record passage," and beyond the fact of the **Aurania** having become noted for a serious breakdown of machinery which disabled her for months, they never became remarkable.

As may be surmised by the number of vessels which about this time were being brought out by the Cunard Line, they were endeavouring to gain the "premier posi-

tion" on the Atlantic which they had now relinquished for over fifteen years; and it is remarkable that it was by the purchase of a vessel from a competing company, which had already beaten the record, that they at last succeeded in regaining it. This vessel was the magnificent but ill-fated **Oregon**, which they purchased and first sailed June 7th, 1884, and which will be commented on later. Suffice it here to say, that after two short years of very successful working for the Cunard Line, and a short experimental service under the British Admiralty, during which she afforded admirable experience, her career was suddenly terminated by colliding with an American wooden schooner off Fire Island, outside New York Bay, on March 11th, 1886.

This memorable event startled the whole maritime world, and the usual alarming statements and prophecies about bulkheads once more became fast and furious; but that the ingenuity and care of both ship-builders and ship-owners had not been thrown away, is shown very distinctly by the fact that the Cunard Line still retain their noted record of *never having lost a passenger's life*, whereas had the bulkhead division not been efficient and of sound workmanship, thus enabling her to be kept afloat for some hours, it is more than probable that the loss of life would have been appalling.

Amongst the numerous vessels brought out by the Cunard Line, none have become more famous than the well-known **Umbria**, which first sailed October 31st, 1884, and the **Etruria**, on April 25th, 1885. They were of steel, 500 feet long, 57¼ feet broad, 38¼ feet deep, and 8120 tons.

R.M.S. UMBRIA (1884) AND ETRURIA (1885). CUNARD LINE.

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THE CAMPANIA (1892). CUNARD LINE.

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They were built by the firm of John Elder and Co., then re-constituted under the name of the Fairfield Shipbuilding and Engineering Co., which had also built the **Oregon**, whose satisfactory performances had no doubt led to the placing of the order with them; and it is worthy of notice that these were the first vessels actually built for the line which succeeded in making the fastest record passages in recent times.

In December 1892 the first-mentioned vessel became noted owing to the breaking of the thrust-shaft at sea on an outward passage, but it was so skilfully repaired by the engineers as to enable her to complete the voyage to New York under her own steam.

The last vessels for the express service built by this line were named the **Campania** and **Lucania**; the former was launched from the Fairfield Shipbuilding and Engineering Co.'s yard, at Glasgow, on September 8th, 1892, and the latter on February 2nd, 1893. These vessels were built of steel and fitted with twin screws, and are each 598 feet long, 65 feet broad, and 43 deep, and of 12,950 tons. Only two masts or flag-poles are fitted, and two large funnels. Built especially to be the then fastest ocean-going vessels afloat, great engine and boiler power was put into them; the two sets of engines being triple expansion, with five cylinders for each set, that is with a high (37 in. diameter) and low pressure (98 in. diameter) placed tandem fashion on the forward and also on the after crank shaft, and one intermediate cylinder (79 in. diameter) on the middle crank shaft, making ten cylinders in all. The indicated horse-power of the two sets of engines

combined ranged about 30,000, and to supply them with steam there are twelve double-ended boilers, with 96 furnaces, and one single-ended with four furnaces, carrying 165 lbs. pressure, which have a consumption of about 480 tons of coal per 24 hours, the speed per hour ranging about 22 knots. The saloon (which is between the funnels) and state-rooms are slightly after the plan of the **Majestic** and **Teutonic**, but without the single-berth system; the arrangement of the stern for the propeller shafts is also similar, but the rudder, which consists of a steel frame, and one plate measuring 21 feet by 11 feet 3 inches and $1\frac{1}{4}$ inches thick, is made and fitted somewhat after the manner of that on the **New York** and **Paris** (see p. 66), but in these vessels a projection is made on both sides of the hull proper to make room for the tiller on the rudder-head, which is worked by steam gear. The saloon measures 85 feet by 63 feet, and is capable of seating over 400 passengers at one time. The great dimensions of hull and machinery rendered the cost of these vessels over that of any merchant vessel to that date, being £650,000 for each, or £1,300,000 invested in the two. The **Campania** sailed on her first voyage on April 22nd, 1893, and the **Lucania** on September of the same year, since when they have both succeeded in making record passages which are noticed later.[1]

Following the inevitable laws of nature and the dictates of the great manipulator, Father Time, the proprietary of

[1] Following the example of the White Star Line, this line in 1895 inaugurated a cargo service on the Liverpool-Boston route with twin-screw steamers, and commenced the disposal of the older obsolete vessels so long retained.

this great line, like its vessels, has had to undergo change; the first being the handing over of the private ownership from the founders, Cunard, Burns, and MacIver, 1878, to a private company entitled "The Cunard Steamship Company, Limited," and registered on February 23rd, 1878, with a capital of £2,000,000 in 20,000 shares of £100 each. This was changed again to a public company in 1880, the shares being eagerly taken up by the public. Some time afterwards, early in 1883, the Messrs. MacIver withdrew from the Company, and the management was taken over by the directors, assisted by a responsible manager and officials under the direct supervision of Lord Inverclyde, the present chairman, under which *régime* it now remains.

CHAPTER III

PAST AMERICAN LINES

FOLLOWING the Cunard, the next great steamship effort to be noticed is the commencement of the once famous Collins Line, which was founded in the United States in 1848, to wrest, if possible, the trade from the English steamers. This line commenced its first sailing on April 27th, 1850, from New York for Liverpool, by despatching the **Atlantic**, one of four splendid wooden steamships, the others being named **Arctic**, **Baltic**, and **Pacific**, each of which measured 282 feet long, 45 feet broad, and 31½ feet deep, with a tonnage of 2860 tons, built by William Brown, at New York. These fine vessels were a great advance upon the Cunarders then existing, and were the first to have straight stems, and to be fitted up with smoking-rooms, specially set apart for the purpose; other luxuries were the spacious bath-rooms and barbers' shops, and on one or two of the vessels the saloons at first were placed amidships.

The machinery of the **Atlantic** and **Arctic** was constructed by the Novelty Ironworks, and of the **Baltic** and **Pacific** by the Atlantic Works, both of New York, and were all of the side-lever type, having cylinders 96 inches

THE COLLINS STEAMER ATLANTIC (1849).

[To face page 46.

THE COLLINS LINER ADRIATIC (1857).

[To face page 47.

diameter, and 10 feet stroke. The boilers, four in number, were arranged with two rows of furnaces, one above the other, and were fitted with vertical tubes two inches diameter. Steam was carried at 17 lbs. pressure on a consumption of about 85 tons per day. The paddles were 35½ feet diameter, the average speed about 12 knots per hour. Every effort which skill and science could command was put forth in the equipment of these vessels, each costing over £165,000; but cost was considered no object so long as they outstripped the best performances of the Cunard vessels. In this they were successful, but financially they were not, owing, no doubt, to the lavish expenditure; and in September 1854 they received a terrible blow in the loss of the **Arctic**, which was run into by a small French steamer named the **Vesta**, off Cape Race, in a dense fog, and sunk with a loss of 322 lives, amongst whom were the wife, son, and daughter of Mr. Collins, the managing director and promoter of the line.

About two years after this another great disaster befell them in the loss of the **Pacific**, which sailed from Liverpool on January 23rd, 1856, but as to her fate nothing was known, the brief and terrible sentence, "Never heard of," being the only tale of how a noble vessel and her living freight were suddenly engulfed in eternity. The last of the great wooden paddle-steamers, the **Adriatic**, brought out by the Collins Line, arrived in Liverpool in December 1857, and was by far the finest and fastest vessel built up to that date. She was constructed by Steers, at New York, and was 355 feet long, by 50 feet broad, and 35 feet deep, her gross tonnage being 3670. Upon the withdrawal of

THE COLLINS LINER ADRIATIC (1857).

[To face page 47.

diameter, and 11 feet stroke. The [illegible]
were arranged with [illegible]
other, and were fitted [illegible]
diameter. Steam was [illegible]
consumption of [illegible]
35½ feet diameter [illegible]
hour. Every effort [illegible]
was put forth [illegible]
costing over [illegible]
so long as they [illegible]
Cunard vessels. [illegible]
ally they were not [illegible]
ture; and in [illegible]
blow in the [illegible]
small French steamer [illegible]
a dense fog, and [illegible]
whom were the wife [illegible]
managing director and [illegible]

About two years after [illegible]
them in the loss of the Pacific [illegible]
on January [illegible]
the brief and [illegible]
the only [illegible]
were [illegible]
wooden paddle-steamer [illegible]
Collins Line [illegible]
was by far the finest [illegible]
date. She was [illegible]
was 335 feet long [illegible]
gross tonnage being [illegible]

the Collins Line in January 1858, she was laid up, then sold to be put upon the service from Galway (Ireland), promoted in 1861; but the line being unsuccessful she was again laid up in Birkenhead, and afterwards sold to serve as a hulk in the west of Africa. The two remaining boats, the **Atlantic** and **Baltic**, after being used by the United States Government during the Civil War, were for a brief period on the Bremen route, and later on converted into sailing ships, as which they were afloat until the end of the seventies, but have now disappeared.

In 1845 a small wooden auxiliary screw-steamer, named the **Massachusetts**, measuring only 161 feet by 21·9 by 20·1 feet deep, and of 750 tons, with engines of 170 horse-power (cylinders 26 inches diameter and 3 feet stroke), commenced to trade from New York to Liverpool under the American Flag, and was owned by Mr. R. B. Forbes of Boston, U. S. A., but only made one or two voyages. A sister boat, named the **Edith**, was sold to the United States Government before making a voyage.

In 1847 the Americans established a fortnightly line, called the Ocean Steam Navigation Co., between New York and Bremen, touching at Cowes, Isle of Wight, with two wooden paddle-steamers, built by Westervelt and Mackay, N. Y., named the **Washington** and **Hermann**. The former was 236 feet long by 39 broad and 31 deep, of 2000 gross register tons, and the latter 241 feet by 40 feet by 31 feet, of 2200 gross tons. The engines of both vessels were built by Stilman and Allan, of the side-lever type, with cylinders 72 inches diameter and 10 feet stroke, indicating about 1400 horse-power. The contract for the mails

was £40,000, but the line was only carried on for a little over a year.

With the first sailing of this Company's steamer **Washington**, in June 1847, there came about the first case of Atlantic steamers competing with one another in speed on the passage across. This event was eagerly watched by the respective owners and nations, but notwithstanding that the **Washington** was a larger and more powerful boat, her rival, the first Cunarder **Britannia**, succeeded in outstripping her.

The first full-powered, ocean-going steamer sent across the Atlantic by the Americans was named the **United States**, and was built by Webb of New York, who was then building most of the vessels of the Black Ball Line of sailing clippers. The dimensions were 256 feet long by 50 broad and 30·6 deep, of 2000 tons gross; the machinery was of the side-lever type as then used on the Cunard vessel.

This vessel arrived in Liverpool on April 22nd, 1848, as one of the Black Ball fleet, but only made one or two trips, and was sold to one of the European Governments.

The same year, 1848, the New York and Havre Steam Navigation Co. was formed by the Americans, to carry the mails between those ports and touch at Southampton, the subsidy being £30,000 per annum. Their first vessel was the **Franklin**, a wooden paddle-steamer, 263 feet long by 41·8 broad and 26 deep, of 2400 tons, with 1250 indicated horse-power, which sailed on her first voyage in 1850, and was followed by the **Humboldt**, a slightly larger vessel of the same type, in 1851. These steamers kept up the

service until December 1853, when the **Humboldt** was wrecked near Halifax, and the **Franklin** also came to grief on Long Island, in July 1854. Notwithstanding these disasters, the service was still kept up by chartered vessels, until their new steamers, the **Arago** and **Fulton** came out, the former in June 1855, and the latter in February 1856. These vessels were wooden paddle-vessels, somewhat larger than the **Humboldt**, but had engines with oscillating cylinders, each 65 inches diameter, and 10 feet stroke. With these two boats the service was carried on until 1861, when they were withdrawn, owing to the outbreak of the Civil War in the United States.

In the years 1857, '58, '59, and 1860, several American-built wooden paddle-steamers were from time to time put upon the Bremen and New York route, calling at Southampton, also on the Havre-New York route, calling at Cowes.

The first of these to be constructed was the **North Star**, built in 1852 by J. Simonson, nephew of the famous Commodore Vanderbilt. Another was named the **Northern Light**, and two others the **Ariel** and **Ocean Queen**; but the largest and most famous was one named the **Vanderbilt**, also built by Simonson at New York in 1855, for Commodore Vanderbilt. This fine craft measured 331 feet long by 47·6 broad and 32½ deep, with a gross tonnage of 3360 tons. The machinery was made by the Allaire Works, N.Y., with two overhead (American type) beams, having two cylinders, each 90 inches diameter and 12 feet stroke, indicating about 2800 horse-power, and having a steam-pressure in the boilers of 18 lbs.

After running on the Havre-Cowes route until November 1860, and making one trip on the Bremen route in 1858 (during which she averaged 13 knots per hour), this fast vessel was presented by Commodore Vanderbilt to the United States Government on the outbreak of the Civil War. She was then laid up for some time, and occasionally used for various trades, until 1873, when she was bought by a San Francisco firm, who sold the machinery and converted her into a full-rigged, three-masted ship, named **The Three Brothers**, then the largest afloat, and after a short career she was bought by a British firm to serve as a hulk at Gibraltar.

Another American venture was the New England Ocean S. S. Co., which was formed by Harnden and Co. of Boston, to trade between that port and Liverpool, but they only placed one vessel, an iron screw-steamer, named the **Lewis**, of 1105 tons, on the route. The first voyage was made in October 1851, and the last, a few months later.

In 1866 a line was established by Ruger Brothers of New York, and was named **The North American Lloyds**, the route being from New York to Bremen, calling at Southampton. The steamers used for this service were the two remaining Collins Line boats, **Atlantic** and **Baltic**, and a steamer named the **Western Metropolis**.

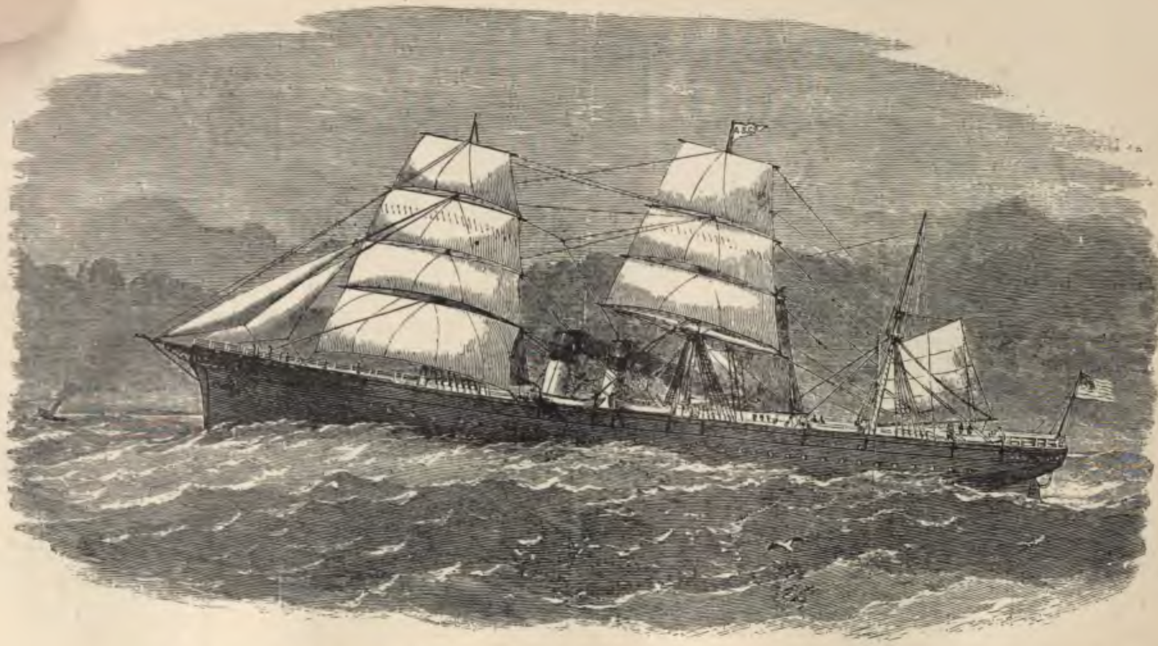
In addition to these one of the most extraordinary steamers ever built, named the **Ericsson**, was chartered. This steamer was built in 1852, with two masts and the ordinary paddle-wheels, but had no funnels, the machinery being on what is known as the Caloric principle, which

rendered them unnecessary. The dimensions of the hull, which was of wood, by Perrione Patterson and Stack of Williamsburgh, were 250 feet long by 40 broad and 31 deep, with a gross tonnage of 1920. The Caloric engines, which were built by Hogg and Delemater of New York, had four huge cylinders, driving paddle-wheels each 32 feet diameter, and were reported to have propelled the ship at 12 knots for six tons of fuel per day, but further trials did not confirm this; and after being fitted with a second set of Caloric engines in 1855, ordinary steam-engines were eventually fitted.

The peculiar design of the heating medium served to produce modifications in the exterior as well as the interior of the vessel. On the upper deck, in place of the ordinary funnel as in steam-ships, four tubes only 30 inches in diameter were placed; the two corner chimneys being connected to the cylinders of the engine, the others protected the hold from the impure and heated air. No machinery prevented free passage of the upper deck fore and aft. The four tubes rested upon pedestals, and were formed, two of sheet-iron and two of wood. Beside each pair of tubes was a well, extending to the bottom of the ship, through which a current of cold air was carried down to the fire-room.

The dining-saloon was located aft of the engines, with the state-rooms below; to which easy access was obtained by wide stairways. The appointments of the saloons, state-rooms, and other parts of the vessel intended for the accommodation of passengers were very sumptuous.

Returning to the lines, the Ruger only lasted a brief



THE STEAMSHIP ONTARIO (1868). BOSTON AND LIVERPOOL LINE.
Only Wooden Screw on the Atlantic Ferry.

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period, and after an attempt at resuscitation it was given up in 1868, and the following year (1869) the same firm endeavoured to promote a regular service between New York, Copenhagen, and Stettin, but were again unsuccessful.

A few years after the Civil War, another attempt was made by the Americans to form an Atlantic Line, by the formation in Boston of the American Steamship Company, with a capital of £260,000 (this is not to be confounded with the American Line of to-day, which is noticed later). This line commenced between Boston and Liverpool, in 1868, with a wooden screw-steamer named the **Ontario**, which was built together with a sister vessel, the **Erie**, by Jackman at Newburyport, Mass.; they were 322 feet long by 43·9 feet broad, and 29 feet deep, and of 3000 tons. The machinery was of the vertical geared type after the style of the **China**, illustrated on page 38, with cylinders each 74 inches diameter, and 4 feet stroke, and indicated 1700 horse-power. The service was carried on only a short time, the **Ontario** having made but three trips when financial disaster overtook the Company, and the two boats were disposed of.

Other lines, which existed for but brief periods, were the Cie. Franco-Américaine, between Havre and New York, in 1857, which lost one steamer, **Le Lyonnais**, sunk by collision off Nantucket in 1857; then the Kunhardt Line of German steamers in 1858; and the Cie. Transatlantique-Belge between Antwerp and New York, in 1858.

CHAPTER IV.

THE INMAN, ANCHOR, AND ALLAN LINES.

JUST ten years after the foundation of the Cunard Line (namely in 1850), a line which for forty-two years afterwards held a front rank on the Atlantic Ferry made a small beginning with an entirely different type of vessels from the form then existing. This was the formerly well-known Inman Line, and was announced by the following advertisement in the *Liverpool Mercury*, Dec. 6th, 1850—

"*Steam communication between Liverpool and Philadelphia.*—The powerful screw steamship **City of Glasgow**, B. E. Matthews, late of the **Great Western**, Commander, 1610 tons, 350 horse power, is intended to sail as under:

"*From Liverpool.*—Wednesday, 11 Dec.; Wednesday, 12 Feb., 1851. *From Philadelphia.*—Thursday, 16 Jan., 1851; Thursday, 13 March.

"This vessel is well known from her successful voyages between Glasgow and New York, and has ample state-room accommodation for about 120 first and second cabin passengers; no steerage passengers taken.

"*Rates of Passage.*—*From Liverpool.*—1st Cabin, 22 guineas; 2nd Cabin, 13 guineas. *From Philadelphia.*—1st Cabin, 100 dollars; 2nd Cabin, 60 dollars.

"These rates include provisions and steward's fee, but not wines or liquors, which can be had on board.

CITY OF GLASGOW (1850). FIRST INMAN STEAMER.

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"*Rates of Freight.—From Liverpool.*—£4 per ton measurement. *From Philadelphia.*—According to agreement.

"Passengers and shippers will find Philadelphia the most central port, possessing railway communication in a few hours and at trifling expense to New York for the North; being also on the main line from the North through Baltimore to Washington and the Southern States, and the great central railway (now open to within 80 miles of Pittsburg on the Ohio) forms the shortest and most direct route to the Western States. All goods sent to the agents in Philadelphia will be forwarded with economy and dispatch.

"For further particulars apply in Philadelphia and New York to Richardson, Watson and Co.; in Belfast to Richardson Brothers and Co.; in Glasgow to Patrick Henderson and Co.; and in Liverpool to

"RICHARDSON BROTHERS AND CO.,
"12 and 13, Tower Buildings,
"Liverpool."

This service was founded by Mr. William Inman, of Liverpool, in conjunction with the firm of Richardson Brothers, of the same place, the intention being to trade between Philadelphia and Liverpool. Their first steamers were the **City of Glasgow** and **City of Manchester**; the former, which was originally built to trade between Glasgow and New York, was described as follows by the *Glasgow Courier*—

"A NEW ATLANTIC STEAMER.

"Our citizens will shortly have the gratification of witnessing the starting from the Broomielaw of the first ship of a line of magnificent steamships to sail direct between Glasgow and New York. The honour of this undertaking is due to the enterprise of our townsmen, Messrs. Tod and M'Gregor, who have already their first

vessel in a state of considerable forwardness, and is expected to be ready for launching from the stocks by the end of February.

"The **City of Glasgow**, for such is to be the distinguishing name of the splendid steamship now rapidly approaching completion in Tod and M'Gregor's yard, is built of iron, and is of imposing dimensions, although her beauty and symmetry apparently detract from her real magnitude. She is a three-decker, of about 1600 tons measurement over all, and is to be propelled by a screw 13 feet in diameter and 18 feet pitch, which is to be worked by two lever beam-engines of 350 horse-power. The machinery, etc., will all be placed so low as to leave the sweep of the decks clear without encumbrance. The spar-deck will form a magnificent promenade in fine weather, and in foul weather the main-deck affords ample space for recreation, perfectly lighted and ventilated, and protected from rain or spray. The total length of the main-deck is 237 feet, and the breadth 34 feet. On each side are ranged the state-rooms, leaving 16 feet clear in the centre. The height between decks is 7 feet.

"The accommodation for each class of passengers is admirable and most complete. She will carry 52 cabin, or first-class, passengers, 85 second-class, and 400 steerage emigrants. The crew, including officers, engineers, firemen, stewards, sailors, etc., will probably number about 70, so that she will carry a total living cargo of upwards of 600. Two of the state-rooms for first-class passengers have four berths in each, all the others have only two. The state-rooms for second-class passengers have four and eight berths in each. The state-rooms for ladies are so capacious that they may be used as sitting-rooms, should they choose to retire from the main-cabin. The latter is an apartment of noble dimensions, and will be elegantly fitted up, and furnished with a well-assorted library. The walls will be decorated with panellings representing views of places of interest on both sides of the Atlantic. One room is being fitted up as an apothecary's shop, from which the surgeon

will dispense his medicines. Near this is the bath-room, with apparatus for pumping up the salt water from the Atlantic. In fact, nothing has been left undone which science and ingenuity can suggest to add to the comfort and convenience of the passengers. Nor has their safety been uncared for in the construction and fittings of this noble ship. By means of five water-tight bulkheads the vessel is divided into six compartments, so that she would float although several of these divisions were filled. She will be furnished with six capacious lifeboats, having copper tanks under the seats to render them buoyant. Danger from fire has likewise been carefully guarded against. The lamps which light the state-cabins can only be opened by the officers of the ship; and powerful pumps, to be worked by the engines, are supplied so as to extinguish at once any fire which might break out. In the bottom of the hold are placed iron tanks to contain 13,000 gallons of fresh water. There will be ample storage for 1200 tons of goods.

"In addition to the screw motive power the **City of Glasgow** is barque-rigged, and will carry an enormous press of canvas."

The **City of Manchester** was also built of iron, upon the Clyde, by Tod and M'Gregor, and was 258 feet long, 34¼ feet broad, and 25 feet deep, and of 2125 tons, and had overhead geared engines of 350 horse-power, constructed by the same firm, with cylinders 71 inches diameter, and stroke of 5 feet, driving a two-bladed screw-propeller. Steam at 10 lbs. pressure was generated in three boilers having nine furnaces. With the advent of these vessels commenced the long-waged war of paddle *versus* screw ocean steamers; so that although the **Great Britain** and **Sarah Sands** had been previously in the trade, to the Inman Line belonged the honour of having intro-

duced the first successful iron screw-steamer, to which Company's notice it was brought by Mr. Tod, of the firm that built the vessel. Another important trade, first inaugurated by Mr. Inman, was the carrying of steerage passengers by steamships, which traffic was then altogether monopolized by the sailing ships already mentioned. The first sailing was the **City of Glasgow**, which left Liverpool on December 11th, 1850, for Philadelphia, followed soon after by the **City of Manchester** in June 1851, the **City of Pittsburg**, a wooden screw built at Philadelphia in October 1851, and the **City of Philadelphia** in 1853. To distinguish them from the Cunard Liners, the funnels were painted black with white stripe, and the house-flag was red with white square having a black diamond in it.

In October 1854 the Crimean War led to offers being made to obtain the services of the steamers of the line as transports, and this brought about the retirement of Richardson Brothers from the management in order to express as Quakers their disapproval of the steamers being used as transports for troops. Mr. Inman then became sole manager, and at once chartered the **City of Manchester** and **City of Baltimore** to the French, and also, later on, the new **City of Washington**; these steamers remained under charter until March 1856. On the 31st December, 1856, the **City of Washington** commenced the service to New York owing to the fact of the steamer **Kangaroo** being then icebound at Philadelphia for five weeks with all her passengers on board.

This new departure proving satisfactory, was maintained, and in 1857 the official name of the Company was changed

from "The Liverpool and Philadelphia Steamship Company" to "The Liverpool, *New York*, and Philadelphia Steamship Company," as which it remained until 1875, when it was changed to "The Inman Steamship Company, Limited." The Philadelphia sailings were altogether given up in 1857, and later on in that year the steamers commenced calling at Queenstown with the **City of Baltimore** in May, since which time it has always been the first port of call. After the former event the direct rivalry between this line and the Cunard commenced; the latter having by that time got rid of their old rival, the Collins Line, found another coming forward with a modern style of screw-steamship, to compete with them for a share of the enormous subsidies which were at that time in vogue.

This rivalry soon bore good fruit as far as the public were concerned, as each succeeding new vessel was always built to outstrip the performances of the other line's crack ship, as well as to surpass it in the elegance of the fittings.

In 1869 the Cunard Company, in the matter of speed, was eclipsed by the performances of the Inman steamer **City of Brussels**, which made a splendid run home of 7 days, 22 hours, 3 minutes; and as the first **City of Paris** had in 1867 made the fastest outward passage, their rival had to yield the palm.

The first **City of Paris** was built and engined by Tod and M'Gregor of Glasgow in 1866, and was 346 feet long, 40½ feet broad, and 26 feet deep, and of 2651 tons, her engines being of the horizontal trunk type, with cylinders of 89 inches diameter, and 3 feet 6 inches stroke, consum-

ing 105 tons per day, the speed being 13½ knots per hour. She was afterwards lost at sea in March 1885, under the name of the **Tonquin.**

After the advent of this noted craft in 1866, great public interest was excited in the doings of the vessels of this line and the Cunard as to which would make the fastest

THE FIRST CITY OF PARIS (1886). INMAN LINE.

record, the voyages of this vessel and the **Russia** being eagerly watched; but in November 1867 she succeeded in beating the record, viz. in 8 days 4 hours, on the outward run; and in 1869 the **City of Brussels** made the homeward record of 7 days, 22 hours, 3 minutes, which records were retained by the line until 1872.

The **City of Brussels**, built by the same firm, was launched in 1869. She was 390 feet long, 40¼ feet broad, 27 feet deep, and of 3081 tons. The engines were horizontal

direct-acting trunk engines with surface condenser, having two cylinders each of 90 in. diameter, 4½ feet stroke, and steam-pressure of 30 lbs., which propelled her at a speed of nearly 14½ knots on a consumption of 110 tons per day.

One of those important details which are so vital in the successful working of these great vessels was first adopted on this ship, namely the steam steering gear which had recently been introduced and tested on the **Great Eastern**. This valuable auxiliary was designed and successfully worked out by Mr. MacFarlane Gray of the famous Vauxhall Foundry, Liverpool, owned by George Forrester and Co., which has since disappeared like some of the other great firms, such as Woods, Vernon, Jack, and others who have helped on the great civilizer of our day—the ocean steamship.

The career of the **City of Brussels**, the first to reduce the passage to under eight days, in December 1869, deserves notice, for she was the last of a type of steamship which was at this date much in vogue, having a long narrow wooden deckhouse with high bulwarks, giving but limited space to the passengers.[1] This was afterwards done away with in 1872, another deck being added and other extensive alterations made to enable her to compete with newer rivals which had come upon the scene. Later, in 1876, the original engines and boilers were removed and replaced by four-cylinder tandem compound engines, and in the year 1877 she was the object of attention, owing to a very long delay in arriving caused by the breakage of the shaft, as there were on board many Catholic pilgrims

[1] See **China's** cabin plan, page 38.

bound to Rome on the occasion of the jubilee of his Holiness Pius IX.

In 1883 her career was suddenly ended by a collision with a steamer named the **Kirby Hall**, which cut into and sank her in a dense fog, off the mouth of the Mersey, on January 7th, 1883.

Following the usual order of things, this famous vessel

CITY OF BRUSSELS (1869). INMAN LINE.

was succeeded by others to maintain the efficiency of the fleet. The **City of Richmond** and other vessels were brought forward, and in 1875 the **City of Berlin** commenced sailing. This vessel was built and engined by Cairds of Greenock; she was 488½ feet long, 44¼ feet broad, 35 feet deep, and of 5491 tons. The engines were of the two-cylinder compound two-crank vertical type, with cylinders of 72 and 120 inches diameter, and stroke of 5 feet 6 inches, the boiler-pressure being 75 lbs., generated

THE INMAN LINE CITY OF ROME (1881), AS ORIGINALLY RIGGED.

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in twelve boilers having thirty-six furnaces. The consumption per day was about 120 tons, and her average speed about 16 knots on the passages made outward in September and homeward in October 1875. These were the fastest ever made up to that time, and were much commented upon, the record being wrested from the newer rival, the White Star Line, which, commencing in 1871, had till then held the premier position. The first use of the "electric light" in this trade was made in this steamer, which was fitted with it in November 1879. In 1887 new triple expansion engines and boilers were supplied by Lairds, of Birkenhead, and forced draught on the Howden system fitted, but this was again altered in 1892 to the system of induced draught introduced by Messrs. John Brown and Sons, Sheffield, and in 1898 she was sold to the United States Government.

After a period of six years, during which time other lines were bringing forward noble vessels to obtain the much-prized "fastest passage," another beautiful vessel, the **City of Rome**, was launched for this line at Barrow, on June 14th, 1881, and sailed on her first voyage from Liverpool, October 18th, 1881. She was the subject of much comment when being built, but the great expectations entertained were not realized. Built of iron throughout, she was 560 feet long, 52¼ feet broad, and 37 feet deep, and of 8144 tons; three funnels were for the first time fitted, which being uniformly spaced with four masts, gave the vessel a noble appearance in conjunction with the graceful bow and general outline of the hull. For the machinery, which was also by the Barrow Com-

pany, the three-crank engine was adopted, but it differed from the other types in the fact that there were six cylinders, three high-pressure, each 46 inches, and three low-pressure, each 86 inches diameter, fitted tandem fashion, with a stroke of 6 feet. A great departure was made in the working of the slide-valves by means of spur-wheels, which geared the weigh-shaft (on which the eccentrics were fitted) with the crank-shaft, and thus enabled the valves to be fitted at the back of the cylinders. Hollow shafting was also fitted throughout, except for the propeller length.

The boilers, which were of the usual type in iron, carrying 90 lbs. pressure, were eight in number, with forty-eight furnaces placed two and two in fore and aft line, which enabled a water-tight bulkhead to be fitted fore and aft on each side, so as to form the coal bunkers; this excellent arrangement was, however, altogether altered, as well as other parts of the machinery, after she was returned to the builders, with a view of attaining a speed more in accordance with the newer Atlantic vessels. After completion of these alterations, she was again put in the Express Service, under the auspices of the Anchor Line, in 1884, where she remained until 1891, and was then transferred to a summer service between Greenock and New York, where she still continues.

With the exception of the **City of Chicago**, bought to replace the **City of Brussels** in 1883, no steamers were added to this line until the new *régime*. The Inman and International (noticed later) placed upon the service the famous twin-screw steel steamers then known as the **City**

CITY OF NEW YORK (1888) AND CITY OF PARIS (1889).
(Inman and International Line.)
First Twin-Screw Express Atlantic Liners.

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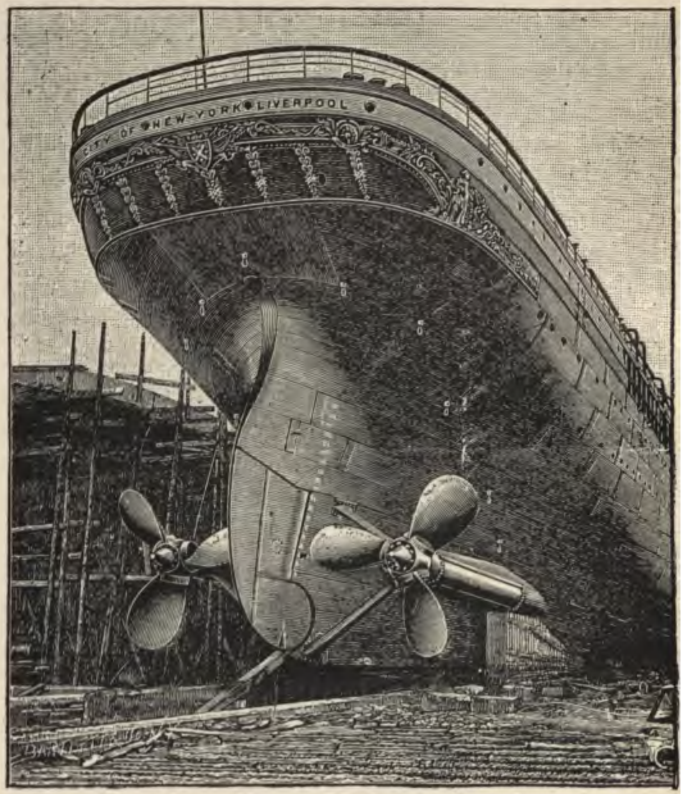
of New York, in March 1888, and **City of Paris**, in April 1889, but in 1893, when this line was absorbed into the American Line, they were named simply the **New York** and **Paris.** The introduction of these splendid ships to the Express Transatlantic Service marks one of those epochs of complete transformation in type of vessel, which, as the years roll by, the demands of the public necessitate, and the advance of engineering science renders possible. In the design and construction of hull and machinery great advances were made, steel being very extensively used; and following the idea of the builders, Messrs. J. and G. Thomson, great breadth of beam was adopted, the most minute subdivision into water-tight compartments, effected by numerous transverse and, for the first time, fore and aft mid-line bulkheads. These were rendered practicable on account of the adoption, for the first time, in the Express Service, of the " twin screw " system of propulsion. Another great novelty was the adoption of the water chambers, to lessen the rolling in a sea-way.

The general outline was somewhat after the handsome appearance of the **City of Rome**, there being three funnels and three pole-masts with but little sail power, the introduction of the twin screws having evidently sounded the death-knell of all the time-honoured and romantic associations of the glistening sail and flowing sheet.

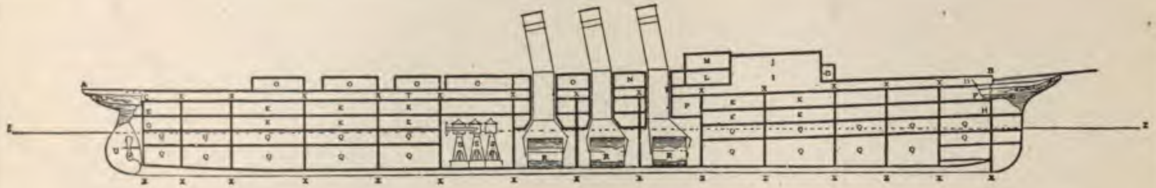
The machinery consisted of two separate (port and starboard) sets of three-crank triple engines possessing all the latest improvements; the boilers being fitted with forced draught on the closed stokehole system on the **City of New York**, and by Howden's system on the **City**

of Paris, and carrying 150 lbs. pressure. One of the most marked innovations which deserves notice was the



STERN OF CITY OF NEW YORK, SHOWING PATENT RUDDER AND TWIN SCREWS.

new arrangement of the rudder; this, unlike the usual type, had no part above the water-line, although the hull



AB Promenade Deck.
CD Saloon Deck.
EF Upper Deck.
GH Main Deck.
I First Cabin Dining-Saloon.
J Dome of Dining-Saloon.
K State-Rooms.
L Drawing-Room.
M Bridge.
N Library.

O Promenade Deck Suites and Cabins.
P Kitchen.
Q Cargo Compartments, Baggage, and Store-rooms.
R Boilers.
S Engines.
T Smoking-Room.
U Rudder.
V One of the Twin Screws.
XX Water-tight Bulkheads.

BULKHEADS OF THE CITY OF NEW YORK AND CITY OF PARIS.

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was so outlined or built as to look as if there were, but in this case the rudder proper only reached to a foot or two below the water-line, having the stock passing through a water-tight stuffing-box into a compartment in the run, in which a powerful steering gear was placed. This, like all the other auxiliary machines on board, was worked upon Brown's hydraulic system, which was hitherto entirely unknown in this trade.

The first of these fleet argosies was the **City of New York**, which came out in 1888, and was followed in 1889 by the **City of Paris**; the splendid runs of the latter soon brought them to the front rank, and in May 1889, the honour of being the first to reduce the passage to below six days fell to the **City of Paris**.

Public attention was much turned to this vessel early in 1890, owing to an accident of exceptional magnitude which occurred to the machinery on March 25th, 1890, when nearing the Irish coast on a homeward run; this, as is now well known, consisted in the complete wrecking of the starboard engine, caused by the breakage of the shaft at the tube mouth. Until this mishap it was generally assumed that total disablement and flooding of both port and starboard machinery was almost impossible, and certainly most unlikely, but like other calculations of man's extensive but nevertheless limited foresight, it was found not to be infallible. Portions of the wrecked engine damaged the mid-line bulkhead, allowing the water, which had, owing to the breakage of the sea connections, filled one engine-room, to flow freely into the other. Although completely disabling the ship, the

breakdown caused no injury to life or limb, and at no time was there any danger of foundering or other fatal accident, for she floated quite safely until towed into Queenstown Harbour, whence, after a short detention occupied in closing the wrecked sea connections and pumping out the water, she proceeded under her own steam to Liverpool; a fact which once and for ever ought to prove that bulkheads, when properly arranged and constructed, will effectually prevent sinking.[1]

Since the advent of these two vessels no others have been added to the time-honoured Inman Line, which has now passed away for ever, as also the prefix City, these two fine vessels having been removed from the Liverpool route to the Southampton, and from under the English flag to that of the United States, in March 1893, and are now known under the names of the **New York** and **Paris**. Like that of the Cunard Line, the proprietary of the Inman Line was changed at intervals. It passed first from the private ownership of its energetic founder, Mr. William Inman, to a private limited company, the Inman Steamship Company, Limited, in 1875, which afterwards, in September 1886, endeavoured unsuccessfully to raise additional capital by the public issue of debentures. The whole organization and fleet was then purchased by the International Navigation Company of the United States, better known as the Red Star Line, and the entire management altogether passed from the well-known name of Inman and the

[1] In May 1899 she stranded on the Manacles Rock, Cornwall, and remained there for two months.

SALOON OF THE CITY OF NEW YORK.

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original house-flag to that of an American ownership represented in England by Richardson, Spence and Co., and was continued under the well-known "I and I" house-flag and name of the Inman and International Line until March 1893, when, to satisfy the longings of the American nation to have a first-class line of their own, the whole undertaking was reorganized, and the name changed to the American Line, with a spread eagle house-flag, and the two vessels, **New York** and **Paris**, transferred to the United States flag, the law which had hitherto existed preventing any foreign-built vessel from flying the flag (United States) being modified to allow of their being so transferred.

Following this important change the route of the steamers was altered from New York to Liverpool to a direct service from New York to Southampton, the further history of which is narrated under the history of the American Line (page 111).

It may not be out of place to describe here one of the first actual sea-going iron screw-steamers to enter upon the Atlantic Trade; this vessel was named the **Sarah Sands**, and although heavily rigged as a sailing craft, yet possessed ample steam power. The builders were James Hudson and Co. of Brunswick Dock, Liverpool, and the dimensions were 182 feet long B.P., 33 broad, and 32 deep, with a gross tonnage of 1400. She was launched in September 1846. The machinery was 300 indicated horse-power, made by Bury, Curtis and Kennedy of the Clarence Foundry, Liverpool, and consisted of two oscillating cylinders, each 50 inches diameter and 3 feet stroke,

working upwards to the crank-shaft, which was coupled direct on to the tunnel-shaft, a most unusual practice in those early days. The boilers were of the wet-bottomed type, fitted with six furnaces, and having ordinary return tubes as now always fitted; the working pressure was designed for 9 lbs. per square inch. The Chief Engineer was Mr. William Glover, the well-known Consulting Engineer of Liverpool, to whom the author is indebted for this and other valuable information.

This vessel sailed on her first voyage from Liverpool to New York on January 20, 1847, the Liverpool Agents being Sands, Turner and Co., trading as the Red Cross Line. She continued on this route until December 1849, then for two years traded between Panama and San Francisco. From that service she proceeded to Sydney, owing to the Gold Fever (as it was termed) prevailing in Australia. From there she returned to Liverpool, and traded for a short time with the Red Cross Line of sailing packets to New York; later in 1854 she went on to the Canadian route, from which she proceeded to the Crimea under charter to the British Government.

The most noted event of her career was the famous trip with troops to India late in 1857, when she took fire in the saloon quarters. This was eventually subdued owing to the hull being of iron, and she arrived at the Mauritius in November with the whole of the after-end completely gutted. From the Mauritius she was sailed home, and the engines having been taken out, she was converted into a sailing ship, and afterwards wrecked near Bombay in 1858.

THE STEAMSHIP SARAH SANDS (1846).

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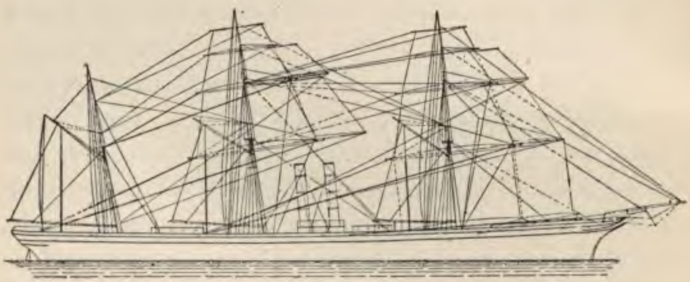
In 1851 a line was formed in Glasgow to trade between that port and New York City, under the name of the Glasgow and New York Steam-packet Company. The first steamer, the **Glasgow**, sailed in 1851, and was followed by the **New York** and **Edinburgh.** The line was fairly successful until 1858, when the **New York** was lost, which proved the first step downwards, for soon afterwards the other steamer was sold to the Inman Line and the service abandoned in 1859.

The first successful line from Glasgow was that known as the Anchor Line, in 1856. This line, under the management of Handyside and Henderson, commenced by despatching the steamer **Tempest** to New York. This trade was, however, only carried on as a secondary one to their Mediterranean trade until 1863, when they commenced with large steamers, the first two being named the **Britannia** and **Caledonia.** The trade increased so rapidly that it was soon found necessary to commence weekly sailings.

One of the modern innovations introduced by this now extensive line was the carrying of dead meat by the dry air process of refrigerating. This was effected on board the **Circassia** by means of machinery especially arranged and made by Bell, Coleman and Co. The enormous trade now carried on in this particular service to every part of the world dates from this particular venture, which was made in March 1879; the first actual experiment was, however, that of the S.S. **Strathleven** in the Australian trade, fitted towards the end of 1878 by the same firm of Bell, Coleman and Co.

The next expansion of the Transatlantic service which is to be noticed was designed to connect Canada with the mother country, and to this end a contract was entered into (in August 1852) by a firm in Liverpool, named MacKean, MacLarty, and Lamont, with the Canadian Government for an annual subsidy of £24,000. Early in 1853 the first steamer, **Geneva**, sailed from Liverpool for Quebec, and was followed by others named the **Ottawa, Cleopatra,**



CANADIAN (1854). FIRST STEAMSHIP OF THE ALLAN LINE.

etc. The service lasted until late in 1854, when it came to an end through the Crimean War causing a demand for steamers as "troopers."

After the termination of this service, another was soon afterwards created by Sir Hugh Allan, of Canada, in conjunction with his brothers in Glasgow, and, under the name of the Allan Line, still flourishes. The first vessel was the **Canadian**, which sailed from Liverpool, on the 20th September, 1854, for Quebec and Montreal; this was an iron screw-propelled vessel built by Denny of Dumbarton, 278 feet long, 34 feet broad, 24 feet deep, and

of 1873 tons, with inverted direct-acting screw-engines by Tulloch and Denny, having cylinders 62 inches diameter, and 3½ feet stroke, the boiler-pressure being 12 lbs. per square inch. Owing to this vessel and her sister, the **Indian**, being chartered by the Government, no further sailings took place until April 1856, when, under the name of the Montreal Ocean Steamship Company, an excellent service was commenced which has since been carried on regularly.

Like the other great lines, the Allan has kept continuously adding to its fleet, from time to time, and such well-known vessels as the **North American**, **Anglo-Saxon**, **Circassian**, **Nova Scotian**, **Polynesian**, **Sarmatian**, have borne the Canadian flag from time to time, down to the handsome steel **Parisian**, built by R. Napier, on the Clyde, in 1880. She was 440 feet long, 46 feet broad, 33 feet deep, and of 5365 tons. The engines, also by Napier, were compound three-cylinder, three-crank type, the diameter of the high pressure 60 inches, and of each of the low 85 inches, with a stroke of 5 feet, and a boiler-pressure of 80 lbs. Since the advent of this vessel many steamers of the cargo type have been added to the Allan Line to supply the demands of their extensive services spreading over the globe, but no attempt was made by them to develop high-speed services to Canada until the year 1898, when orders were given to Belfast and Clyde firms for three large passenger steamers, which were to have moderate speeds of about 17 knots. The first of these vessels was named the **Castillian**, and went on her first voyage in February 1899, but was totally lost near

Halifax, N. S., early in March, when on the homeward run.

Since the commencement the proprietary of the Allan has undergone no change, and it remained a private concern until early in 1897, when it was converted into a private limited company, no shares being allotted to the public.

Spurred by the great desire on the part of the Canadians to have a high-speed direct service, several organizations have from time to time been promoted to supply the wants. In 1888 a contract was entered into by the Orient Line of London with the Canadian Government to commence a service with a guaranteed mean speed of 18 knots, but was not proceeded with.

In 1897, owing to continued agitation for a better service, the Canadian Government, after considerable advertising, concluded an agreement with a Newcastle-on-Tyne firm (Petersen, Tate and Co.) for a service of 20-knot steamers from Liverpool to the St. Lawrence ports in the open season, and Halifax, N. S., in the winter.

For this service it was proposed to adopt what is called the turret type of steamer, specially modified for the requirements of a large number of saloon and steerage passengers, but after considerable trouble and expense and futile endeavours to raise the capital, the scheme fell through early in 1899.

In the spring of 1898, under the friendly auspices and help of the Great Western Railway of England, another trade to Canada was commenced between Milford Haven and Paspebiac, Chaleur Bay, Gulf of St. Lawrence. The first steamer owned by the Company was the old Pacific

Liner **Galicia**, which under the name of **Gaspesia** traded regularly until January 1899, when she was caught in the ice in the St. Lawrence, and kept prisoner there until the following spring, when the ice broke up. Early in the same year two of the older North German Lloyd vessels, named the **Werra** and **Fulda**, were purchased, but owing to a peculiar accident to the latter vessel in a Mersey graving dock noticed later (page 261), she was not accepted. This line was known as the Canadian Steamship Line, and was worked by a Company having that official title, but came to an end early in 1899.

CHAPTER V.

THE GALWAY, NATIONAL, AND GUION LINES.

In 1850, when it was seen that the steam navigation of the Atlantic was *un fait accompli*, attention was turned to form a connection from the western coast of Ireland, the nearest land to the New World. The first one to move the project was an American gentleman named Wagstaff, who visited Galway in 1851, and was there met by the authorities, and the chairman of the Midland and Great Western Railway of Ireland.

The result of this visit was that a wooden cross-channel steamer, named the **Viceroy**, 205 feet long by 30 broad, with side-lever engines having cylinders 68 inches diameter, was despatched on June 1, 1851, for New York, *viâ* Halifax, but only made one voyage.

After this the question lay in abeyance until the year 1857, when it was again resuscitated by John Orrell Lever of Manchester, and in June 1858 a steamer named the **Indian Empire** sailed from Galway for New York, *viâ* Halifax, and was followed in July by another chartered steamer named the **Propeller.**

In October 1858 a contract was made by the promoters with the Newfoundland Government to carry the mails

monthly to St. John's from Galway for £13,000, and the first vessel, an iron-screw steamer, **Circassian**, sailed on January 11, 1859, and was followed by the **Pacific**, **Adelaide**, **Argo**, **Jason**, and **Prince Albert**. Encouraged by this, the Royal Atlantic Steam Navigation Company approached the English Government, and after considerable negotiations, a contract was made in April 1859 to carry the mails from Galway to Portland (M.), also Boston and New York, also to deliver telegraphic dispatches at St. John's (N. F.) in six days, the subsidy being £3000 per trip.

For this Mail Service four fine iron steamers with paddle-engines were ordered, two at £95,000 each, from Palmers' of Jarrow-upon-Tyne, with engines each having three oscillating cylinders, 80 inches diameter and 7 feet stroke, of 2300 indicated horse-power; and two at £97,500 from Samuelsons' of Hull, with engines each having two oscillating cylinders, 98 inches diameter and 7 feet stroke, of 1600 horse-power, which were built in full compliance with Admiralty requirements; their dimensions were 360 feet by 40 broad and 32 deep. The delivery of these vessels was much delayed by various circumstances; the first sailing under the contract took place on July 11, 1860, instead of June, but only one vessel, the **Connaught**, built by Palmers', was ready. After this, misfortune followed the line, this vessel being burned to the water's edge when on the second voyage before reaching Boston, on October 7th, but fortunately no lives were lost.

Owing to this disaster, the names of the coming vessels

were changed from **Ulster**, **Munster**, and **Leinster**, to **Hibernia**, **Anglia**, and **Columbia**.

Later on, in March 1861, the **Hibernia** was strained in a gale, when on passage from Palmers' shipyard on the Tyne to Galway, so that she was rejected by the Postal Authorities; soon afterwards the **Anglia** was severely criticized by the inspectors, and the other vessel, the **Columbia**, was badly damaged by ice in April on her first voyage. Looked upon in the light of to-day, there is no doubt that the defective nature of the hulls was principally due to bad design and workmanship in the shipbuilding yard, which entailed heavy expenditure to rectify.

To carry on the service the **Prince Albert**, formerly the **Duc de Brabant**, was chartered, and the **Adriatic** purchased from the liquidators of the Collins Line in New York, but owing to the unsatisfactory way in which the service was carried out, the Postmaster-General cancelled the contract in May 1861.

Two years later, in 1863, the line was again started from Liverpool, calling at Galway, with a subsidy of £73,000, but was abandoned in January 1864.

After this the steamers were laid up in Birkenhead until 1866, when the **Anglia** and **Columbia** were sold to the Turkish Government, the **Hibernia** and **Adriatic** to a Liverpool firm, who converted the **Hibernia** into a twin-screw steamer and sold her to the Telegraph Construction Company, in whose service she was afterwards wrecked in 1870 near Aspinwall.

The **Adriatic** was laid up in Birkenhead, and converted

THE AMERICA (1884). NATIONAL LINE. [To face page 79.

into a sailing ship, and after two or three trips to San Francisco was sold to serve as a hulk on the West Coast of Africa.

In 1863 the next line was established by some Liverpool merchants with three steamers named the **Louisiana** (later on named the **Holland**), **Virginia**, and **Pennsylvania**, under the name of the National Steam Navigation Company, which was changed in 1864 to the National Steamship Company. From that period a regular trade was carried on both in emigrants and cargo, until about 1887, when the emigrant trade was gradually abandoned, and the steamers both on the Liverpool and London service were entirely adapted for the live cattle and cargo service.

To this line belongs the honour of having first introduced the compound engines to the Atlantic trade, the **Holland** having had the original engines with two cylinders, each 55 inches diameter and 3 feet stroke, removed in 1869, and was fitted with new compound engines by J. Jack and Co. of Liverpool, with two cylinders, one high-pressure 46 inches diameter, and one low-pressure 86 inches diameter, stroke of 4 feet, and boiler-pressure 60 lbs.

A remarkable vessel placed upon the Atlantic in 1884 was brought out by this Company, named the **America**, 432 feet long, 51¼ feet broad, 38·6 feet deep, and 5528 tons. She was designed and built of steel by J. and G. Thomson on their altered proportions; the engines, also by the same firm, were of the usual three-cylinder compound three-crank type, the high-pressure diameter being 63 inches, and each of the low-pressure 91 inches, with a stroke of 5½ feet, and boiler-pressure 95 lbs. The advent of

this vessel was much commented upon, owing to the new departure she represented, as the Company had hitherto specially refrained from the Express Service. A distinctive new feature in the arrangements was a handsome dome over the saloon, which gave it an airy and lofty appearance, and was afterwards adopted in the **New York** and **Paris** and other vessels.

The **America** being driven at a very high speed on considerably less consumption, namely 190 tons per day, than the other "record breakers," soon took front rank. Her general appearance differed from the then prevailing type, there being only two masts and two very lofty elliptic funnels. Notwithstanding that she succeeded in breaking the record in June 1884, by a passage homeward of six days, 14 hours, 18 minutes, she was sold in 1886 to the Italian Government, owing to an alteration having been effected in the management of the Company, which felt reluctant to enter into such an expensive and restless competition.

From this period (1886) the fortunes of the Company were but poor, as no dividends were earned, and in 1889 the steamer **Erin** swelled the list of the "never heard of," and a few months afterwards the **Egypt** was burned at sea (July 1889).

After these disasters a strong effort was made to revive the line, and two freight vessels, the **America** and **Europe**, were built in 1891, but with little success, and in 1894 the vessels gradually ceased sailing from Liverpool. The London and New York service was maintained until early in 1896, when, after stormy meetings of creditors and shareholders in Liverpool, the line, after experiencing financial

losses, was purchased by the Atlantic Transport Line of London, by whom it is still carried on as a weekly service to New York; but with modern vessels. The **Holland** and others were sold to foreign owners, and the **Spain** and **Italy** to break up.

Three years after the National Line commenced, the

THE MANHATTAN (1866). GUION LINE.

managers of one of the then noted fleet of emigrant sailing vessels known as the Black Star Line, seeing that the steamships were drawing all the passenger trade, inaugurated the Guion Line, the founders being Williams and Guion, the former representing the line in New York, and the latter in Liverpool. They commenced in 1866; the first vessel was named the **Manhattan**, an iron screw-propelled vessel, 335 feet long,

42½ feet broad, 28 feet deep, and of 2869 tons, having low-pressure inverted direct-acting surface-condensing engines, with cylinders 60 inches diameter, and 3½ feet stroke. This vessel and the machinery were built by Palmers, at Jarrow-on-Tyne, and was followed by the **Minnesota, Nevada, Idaho**, and others; and later on, in 1870, by the **Wyoming** and **Wisconsin**, iron vessels also built and engined by Palmers, each being 366 feet long, 43⅙ feet broad, 34 feet deep, and of 3238 tons. The engines were amongst the first compound type in the Atlantic trade, with one vertical high-pressure cylinder, 60 inches diameter, and one double-trunk horizontal low-pressure of 120 inches diameter, both working on the same crank, the stroke was 3½ feet, and having Corliss valves; these engines and original boilers, carrying 70 lbs. pressure, were at work to 1893, when the vessels were sold to be broken up.

In 1872, two strange vessels, named the **Montana** and **Dakota**, of entirely different design, both in hull and machinery, from the then existing type of Atlantic steamers, were brought out. Their dimensions were 400⅓ feet long, 43¾ feet broad, 40¾ feet deep; the engines were compound, one high-pressure, working inverted, of 60 inches diameter, on a forward crank, and two low-pressure, working horizontal, on after crank, each 113 inches diameter, with a stroke of 3½ feet, and having Corliss valves. The first boilers (carrying 100 lbs.) of the **Montana** were constructed on the principle of a series of cross tubes, 15 inches diameter, but these failed with loss of life, and were replaced by ordinary tubular boilers, carrying 80 lbs., before she commenced sailing. Although specially built to lead the van on the

Atlantic highway, neither of these vessels succeeded in "breaking the record," and were both afterwards wrecked, the **Dakota** in May 1877 and the **Montana** in March 1880, at places on the Welsh coast within a few miles of each other. After an interval of seven years a splendid vessel, the **Arizona**, was brought forward by the Guion Line; of iron, built and engined by John Elder and Co., Glasgow, and measuring 450 feet long, $45\frac{1}{3}$ feet broad, $35\frac{3}{4}$ feet deep, and 5147 tons. Her machinery was of completely new design to this trade, being compound with three crank-shafts, each having one cylinder, the high-pressure, of 62 inches diameter, being in the centre, and at the low-pressures each of 90 inches, with a stroke of $5\frac{1}{2}$ feet. There were seven boilers carrying 90 lbs. pressure and having thirty-nine furnaces; the consumption per day averaging 125 tons, or about 25 per cent. more than the fastest vessels, **Britannic** and **Germanic**, then existing. These she succeeded in surpassing by making the fastest outward passage in May 1880, and homeward in July 1879. The general design, excepting machinery, was simply a copy of those two noted vessels, as were the other fine vessels brought out by the various lines for some years afterwards.

Soon after the **Arizona** had become noted for her rapid passages, she became more famous by performing a feat hitherto thought impossible, namely, running full speed into a huge iceberg and then returning to port to tell the tale. This remarkable episode occurred in the month of November 1879, on a homeward passage, and resulted in her putting into St. John's, Newfoundland, with

her bow completely smashed and crumpled up almost to the collision bulkhead, which did good service by remaining intact. Beyond the delay and the heavy cost of rebuilding a new bow, this mishap caused no injury to the vessel or the line, but, on the contrary, so proved the excellent con-

THE ARIZONA (1879). GUION LINE.

struction of the hull that she continued to be well patronized until the stopping of the line in 1894, after which she was laid up until 1898, when she was re-boilered, and went to the North Pacific, and was sold to the United States Government.

In consequence of the success of the **Arizona**, another iron steamer, the **Alaska**, built by the same firm, of similar type, but of somewhat larger dimensions and machinery,

THE OREGON (1883). GUION AND CUNARD LINES.

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was put into commission early in 1882, and under the pseudonym of the "Atlantic greyhound" at once became famous by making the "fastest passage," and eventually became the first to reduce the passage homeward to less than seven days in June 1882.

The last vessel to be added to the Guion fleet was the **Oregon** (already briefly noticed in the chapter dealing with the Cunard Line, p. 42 *ante*). This magnificent vessel, which first sailed under the Guion flag, was of iron, and was built and engined by Elders on the same design as the two preceding vessels, but of increased size, her dimensions being 500 feet long, 54 feet broad, 40 feet deep, and 7375 tons. The compound engines were magnificent specimens of marine engineering; they consisted of one high-pressure cylinder 70 inches diameter, placed in the centre, and two low-pressure, each 104 inches diameter, with 6 feet stroke, the boiler-pressure being 110 lbs., and consumption about 310 tons per day. Only a brief time elapsed after the first voyage, on which she sailed on October 7th, 1883, before she became noted for her passages, and eventually, in August 1884, reduced the time of crossing the Atlantic to less than six and a half days. Notwithstanding her magnificent performance with the "red-capped" funnel, she was, for financial reasons, transferred to the Cunard Line in June 1884, and, as already related, was sunk by a collision.

After many years of successful and satisfactory working under the original founders, the organization was turned into a private limited company in 1883, and on the death of Mr. S. B. Guion, which occurred in December

1885, was changed into a public one in November 1886, under the name of the Liverpool and Great Western Steamship Company, Limited, which title it continued to bear until the year 1894.

In that year the last sailing of the line was made by the **Alaska**, which left Liverpool in April; previous to this she had been carrying on the service intermittently with the **Arizona**, the other vessels, **Wyoming**, **Wisconsin**, and **Nevada**, having been sold to the shipbreakers at intervals during 1893.

When it was definitely decided to close the line, the **Alaska** and **Arizona** were offered for public sale in Liverpool, and the highest bids were £20,000 for the **Arizona** (which cost about £200,000 in 1879), and £27,000 for the **Alaska** (which originally cost close on £250,000 in 1882); these bids were not accepted, but will serve to give an idea of the depreciation caused in high-speed vessels by the continued advances in marine engineering, which are still more intensified by the natural changes of trade in itself. So far as the Atlantic Ferry is concerned these changes have been occasioned by the separation of the Express passenger service from the cargo. Another reason for the abandonment of the Guion, and to a certain extent the original Inman Line, is that other newer and more vigorous companies placed upon the service, both from London and Liverpool, huge modern steamers fitted with all the latest improvements of modern science.

CHAPTER VI.

WHITE STAR LINE.

Owing to the long period which elapsed after the formation of the Guion Line, it was thought that the Transatlantic trade had ceased to be a further field for extension, but in 1870 this illusion was dispelled by the formation of the Oceanic Steam Navigation Company, Limited, better known as the White Star Line, which now stands preeminently at the head of the great steamship companies of the globe. It was announced by the following advertisement in the *Liverpool Daily Post*, March 1, 1871, and other papers, in which it may be noticed some of the names formerly used by the Collins Line were proposed, though they were not all adopted.

"White Star Line, Oceanic Steam Navigation Company, Limited.

"The new first-class, full-powered screw steamships **Oceanic, Baltic, Atlantic, Pacific,**[1] **Arctic,**[1] **Adriatic.**

"Sailing on Thursdays from Liverpool, and calling at Queenstown on Fridays to embark passengers.

[1] These names were not adopted, those of **Republic** and **Celtic** being substituted for them.

"Will sail as under for New York, viâ Queenstown. **Oceanic**, 4500 tons, 3000 horse-power, Captain Digby Murray, to sail to-morrow, Thursday, March 2nd, 1871.

"These steamships have been designed to afford the very best accommodation to all classes of passengers, and are expected to accomplish quick and regular passages between this country and America.

"The state-rooms, with saloon and smoking-rooms, are placed amidships, and cabin passengers are thus removed from the noise and motion experienced at the after part of the vessel.

"Passengers are booked to all parts of the States, Canada, and Newfoundland, Nova Scotia, India, etc., at moderate through rates. A surgeon and a stewardess carried on each ship. Drafts issued at New York for sums not exceeding £10, free.

"Parcels will be received at the Company's offices until 6 P.M. of the day before sailing.

"Bills of lading to be had from Messrs. Benson and Holme, and Mawdsley and Son. Shipping notes at the Company's office. Loading berth, S. W. corner Bramley Moore Dock.

"Saloon passage, £18 18*s.* and £16 16*s.*; return ticket, 27 guineas. Steerage as low as by any other first-class line.

"Rates of freight, etc., may be obtained by applying to J. H. Sparks, at the Company's offices, 19, Broadway, New York; in Belfast, to Samuel Gowan and Co., 4, Corporation Street; or to

"ISMAY, IMRIE AND CO.,
"7, East India Avenue, or 10, Water Street,
"London, E.C., Liverpool."

This Company, like some of the others on the Atlantic, was an offshoot of one of the sailing clipper lines of former years, namely the "White Star."

This sailing fleet having come under the management of

THE OCEANIC (1871). FIRST STEAMER OF WHITE STAR LINE.

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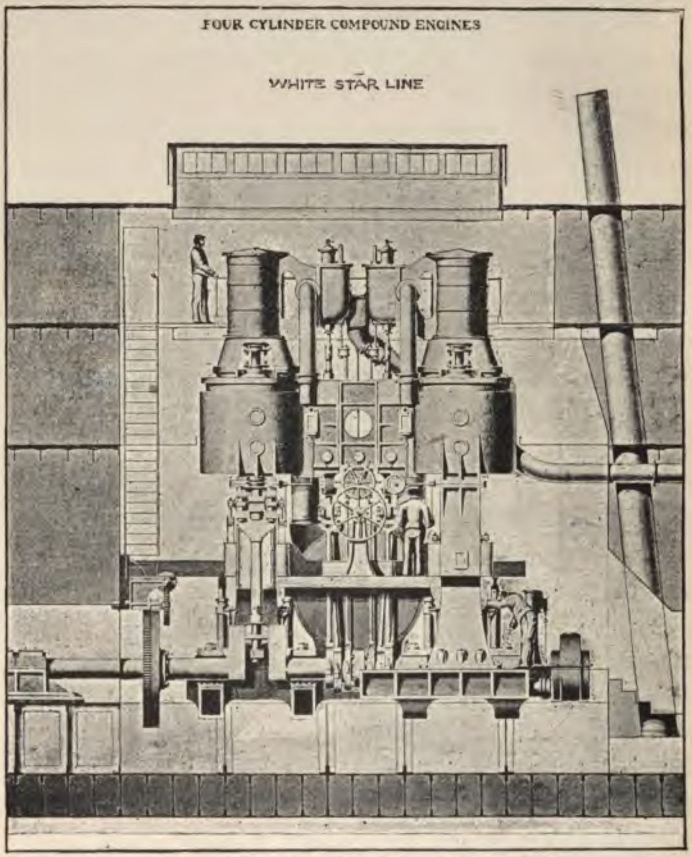
Mr. T. H. Ismay in 1867, who had already had experience of steamships as director of the National Line, already noticed, conceived the idea of establishing a first-class passenger line across the Atlantic with a fleet of steamers in every way superior to anything then in existence, a scheme which was by this time ripe for carrying out, owing to the radical improvements in design of hull and interior arrangements which were then being brought forward by Harland and Wolff of Belfast.

Being substantially supported by several influential shipping men, Mr. Ismay, in 1869, entered into negotiations with the Belfast firm to build steamers of the latest and most modern type, and in 1870 he was joined by Mr. William Imrie, who had been previously a fellow-apprentice of his.

In February 1871, their first steamer, the famous **Oceanic**, appeared upon the Mersey from Belfast; her dimensions were 420 feet long, 41 feet broad, 31 feet deep, and tonnage 3707.

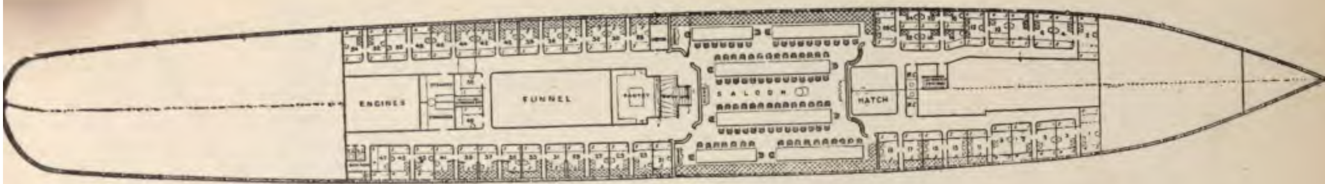
This vessel will long be remembered as the pioneer of those improvements which, since her advent, have made travelling by ocean steamers so thoroughly comfortable and luxurious. The curiosity of every one connected with nautical matters was thoroughly aroused by the way in which the then existing theories and designs of steamships were in this new craft set aside. Instead of the usual high bulwarks and narrow wooden deck-houses, another iron deck was added, with open iron railings for bulwarks, so as to allow the water to come and go on deck; the

saloon was placed amidships, and extended the entire width of the vessel; both forward and aft of the saloon



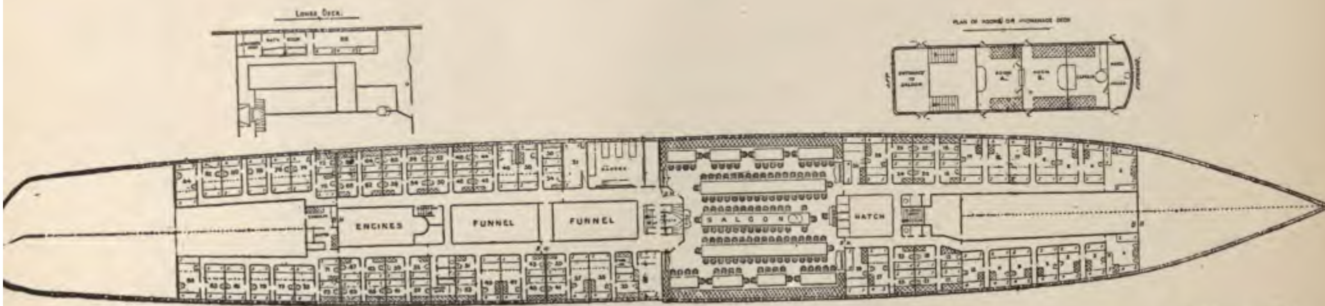
ENGINES OF THE OCEANIC. SIDE VIEW.

the numerous state-rooms were arranged along both sides, and as all the sidelights were about twice as large as any



DECK PLAN OF THE FIRST OCEANIC.

(The first Atlantic Steamer with a midship saloon.)



DECK PLAN OF THE BRITANNIC AND GERMANIC.

(Showing the saloon accommodation.)

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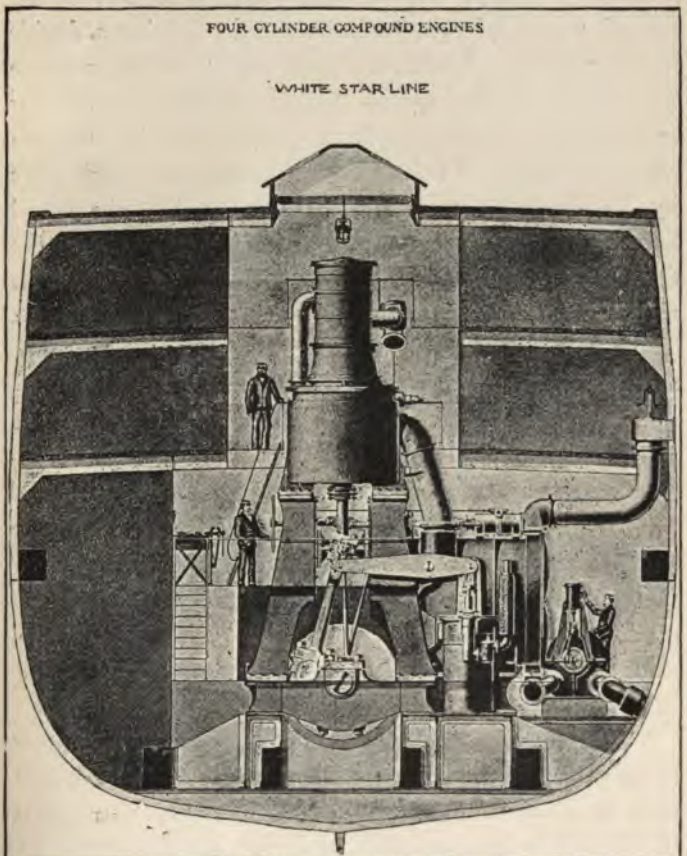
previously fitted to Atlantic steamers, the light and airy appearance of the interior soon took the attention of



ENGINES OF THE OCEANIC. THWARTSHIP VIEW.

Atlantic passengers. The engines also were objects of much attention; they were tandem compound four cylinders,

with two high-pressure, each 41 inches diameter, and two low-pressure, each 78 inches, working on two cranks with a stroke of 5 feet, so that each engine (forward and aft) formed a complete engine in itself, thus forming a double resource in case of breakdown; steam at 65 lbs. pressure was generated in twelve boilers having twenty-four furnaces, and consuming about 65 tons per day with an average speed of 14 knots. These engines, which were by Maudslay, Sons, and Field, London, like the vessel herself, soon satisfied the doubts of all, and allayed the fears of those old "salts" who so confidently declared her to be unfit to face the heavy weather of the Atlantic. The **Oceanic** was followed by others of the same type, and as the service was conducted with great regularity and unprecedented speed, they soon became famous, and in 1872 made the fastest passage outward and homeward.

The *first* **Oceanic**, as she must now be known, terminated her career in February 1896, when she was sold to the shipbreaker for about £8000. Being famous as the prototype of the present form of Express Liner, and also as one of the most successful financial crafts which has existed since the days of steam, it is worth noting the leading incidents of her career.

When she was laid down in 1869, the intention was to send her on the Australian trade, *viâ* the Suez Canal, then announced to be opened the following year, 1870, but before being launched this was given over for the Atlantic Ferry. The launch took place at Belfast on August 27, 1870, the shipyard number being 73. After this she was placed in the Abercorn Basin adjoining the

yard, and had the machinery put on board by means of large wooden sheer-legs temporarily erected for the purpose. This machinery was made by Maudslay, Sons, and Field, London, and transported to Belfast in a small steamer named the **Camel**, which little craft was built specially by Harland and Wolff for the purpose, and also to test the value of the raising and lifting propeller, afterwards fitted on the **Britannic** (see p. 99). She left for Liverpool late in February 1871, and sailed for New York on March 2nd, but put into Holyhead, owing to the main bearings and crank-pins having given serious trouble by heating. After a few days' delay she proceeded to New York, where she was visited by an immense number of people, and after making a few voyages, she returned to Belfast to have some extensive alterations made, amongst which were the shortening of the four masts, the building on of a whale-back at the forward end, and the addition of two more boilers; and last, but not least, the further improvements of the saloon accommodation. She returned to Liverpool, and continued in the New York service until April 17th, 1875, when she sailed from the Mersey for Hong-Kong, *viâ* the Suez Canal, there to inaugurate (together with the first **Belgic** and **Gaelic**) a service on the Pacific between that port, Yokohama, and San Francisco.

On this trade the **Oceanic** became prime favourite, and returned to Liverpool late in 1879 to be modernized both in the passenger accommodation and machinery.

With new boilers and her machinery modified, she sailed on March 16th, 1880, and calling at Suez, Hong-

Kong, and Yokohama, arrived at San Francisco on June 6th following, thus enabling some of the passengers to reach Liverpool again in 75 days from leaving, which was considered remarkable, 80 days being up to then the quickest time to round the globe. From this on she remained on the Pacific trade until the latter part of 1895, when she returned to Belfast *viâ* London, primarily with the intention of having new engines and boilers, but after consideration this idea was abandoned, and rather than see their "famous founder" fall to the fate of a common tramp or hulk, it was decided to end her days, which came about on February 10th, 1896, when she left Belfast to be broken up. Early in 1899 the **Adriatic** was sold to break up, so that the whole of the original once-famous novel "White Star Liners" have disappeared, the **Oceanic** as just noted, the **Atlantic** wrecked with great loss of life on April 1st, 1873, the **Baltic** and **Republic** sold to the Netherland American Line, and known under the names of **Veendam** and **Maasdam.**

(In February 1898 the **Veendam** on an outward passage foundered through the breaking of the propeller shaft, fortunately without loss of life.) The remaining vessel, the **Celtic**, was sold to the "Thingvalla Line of Copenhagen," and the name changed to the **Ameraka**, but owing to the cessation of this line in February 1898, she was sold to be broken up.

In 1874 and 1875 two of the most remarkably successful steamers ever built were brought out, namely, the **Britannic** and **Germanic**; each was 455 feet long, 45 feet

BRITANNIC (1874) AND GERMANIC (1875). FROM A MODEL.

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broad, $33\frac{3}{4}$ feet deep, and of 5004 tons, and was built of iron by Harland and Wolff. The engines, by Maudslay, Sons, and Field, were two crank compound, tandem type, similar to those of the **Oceanic**, the high-pressure cylinders were each 48 inches diameter, and the low each 83 inches, with a stroke of 5 feet. Steam at 75 lbs. pressure was generated in eight double-ended boilers, having thirty-two furnaces, and the consumption averaged about 110 tons per day, with a speed slightly over 16 knots. These vessels were the first to reduce the passage to less than seven and a half days; their splendid performances attracting world-wide attention, and although they are now twenty-five years old, and out of date, they retain their place on the Express Transatlantic Service, sailing every fourth week from each port, the **Britannic** having the original engines and boilers.

In 1895 the **Germanic** was supplied with new triple-expansion engines at Belfast, and in the winter of 1898–99 underwent a strange experiènce. Arriving at the wharf in New York with her deck and upper works laden with ice and snow, owing to the wintry weather prevailing, she on February 13 suddenly listed over and filled through the open coal ports and sank. The result was, the whole of the interior fittings were practically destroyed, and had to be renewed at great expense.

The following article, condensed from *The Engineer*, of October 31st, 1884, is interesting, as showing the cost of high speed—

"*Old and New Atlantic Steamers.*—In June of last year we gave some interesting particulars of the relative per-

formance of the **Alaska**, **Servia**, and **Britannic**, showing the results given by each steamer after crossing the Atlantic almost in company with each other.

"During the present month the **Britannic** has again been crossing about the same time with the two latest additions to the Atlantic fleets, namely, the **Oregon** and **America**, and gives us another opportunity of analyzing the relative merits of the 'Old and New Atlantic Steamers.'

"The **Oregon**[1] and **America**[2] both left New York on Wednesday, the 8th of October, and both arrived at Queenstown on the 15th following, the **Oregon** running a distance of 2819 knots, occupying 6 days, 12 hours, 37 minutes, which gives a speed of 18·01 knots per hour; the **America** running a distance of 2777 knots, occupying 6 days, 17 hours, 43 minutes, a speed of 17·14 knots; the **Britannic** left New York on October 11th, and arrived at Queenstown on October 19th, after running a distance of 2852 knots in 7 days, 12 hours, 17 minutes, which gives a mean average speed of 15·85 knots, thus occupying, say, one day longer than the **Oregon**, and about 18½ hours longer than the **America**.

"By these figures it will be seen that in a period of ten years a gain of one day has been obtained in crossing the Atlantic; and assuming that the consumption of each ship was, respectively, 265, 185, and 100 tons per day, to gain this one day the **Oregon** burned about 1656 tons, and the **America** about 1174 tons on the passage home, whereas the **Britannic** burned only 750 tons.

"If we then consider that, in the case of the steamer **Oregon**, it was necessary to burn 906 tons to gain 24 hours, and in the case of the America, 424 tons to gain 18½ hours on the **Britannic**, it may well be asked, 'Do the New steamers yield the same efficiency as the Old?"

The following table showing the relative horse-powers, etc., will be of interest—

1 Cunard Line. 2 National Line.

	Fastest passage. d. h. m.	I.H.P.	Consumption.	Tonnage.	Speed.
Oregon .	6 12 27	13,000	265 tons	7,250	18 knots.
America .	6 17 43	9,800	185 „	5,530	17·1 „
Britannic	7 12 17	4,900	100 „	5,004	15·8 „

It is to the White Star Line that the public are in a great measure indebted for the considerable advance in marine architecture and engineering, owing to the energetic and judicious way in which it has brought out and developed the improvements now so extensively adopted.

Amongst the most important of these the following may be mentioned, namely—

Introduction of the improved relative proportions of length, breadth, and depth.

Placing of saloon and passenger accommodation amidships.

Adoption of electric bells on board ship.

Providing separate chairs in saloon for each individual.

Self-acting, water-tight doors.

Improved bulkhead division, and carrying them up to proper height.

Introduction of bridal chambers, as in this age of rapid transit, a trip across the Atlantic is not too extensive for a honeymoon.

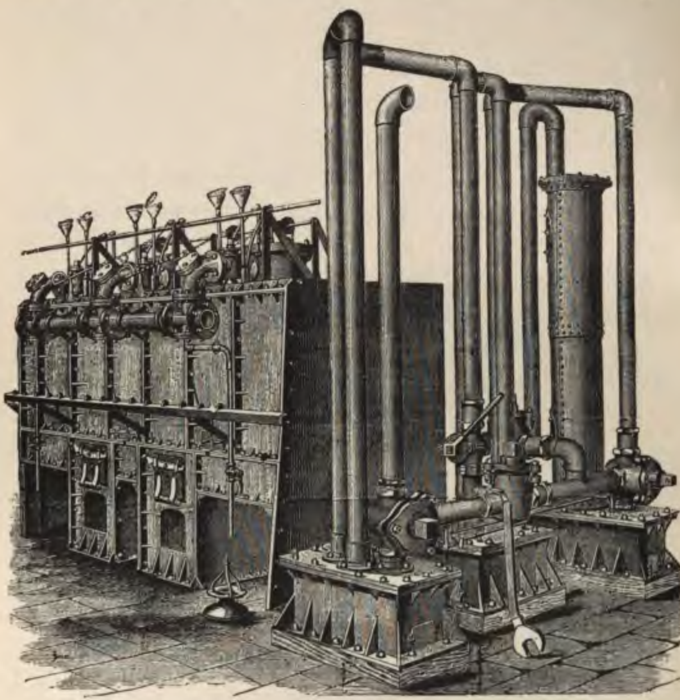
Adoption of Maury's Lane routes.

Overlapping twin screw propellers.

Better system of lighting throughout by the replacing of the candle system in 1872-3 with superior mineral

sperm oil lamps, followed afterwards by an elaborate and commendable attempt to adopt gas lighting.

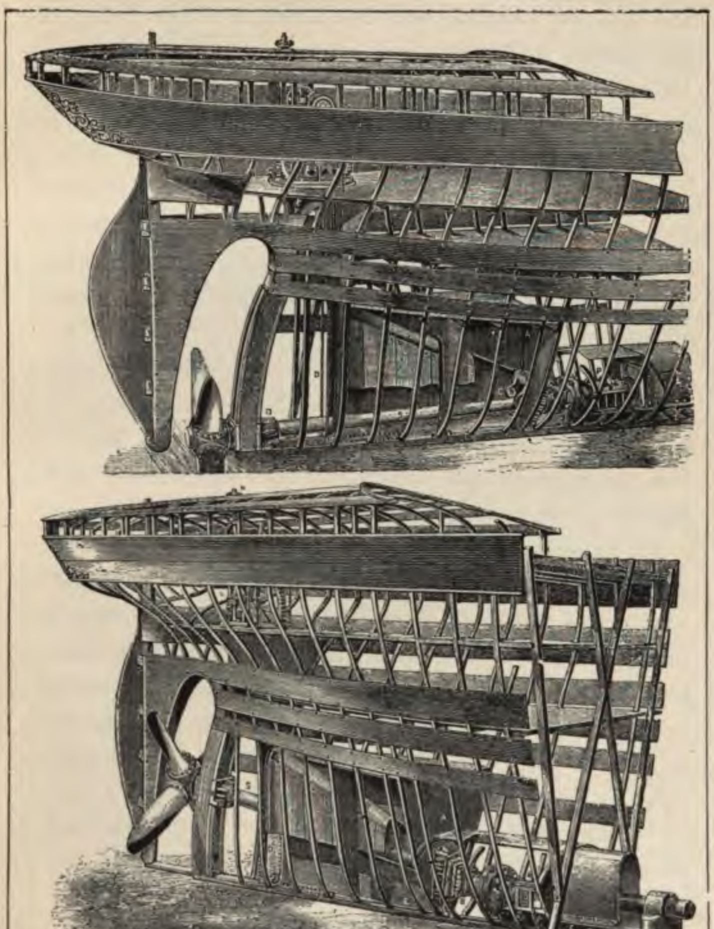
The system of gas supply was somewhat like that now so widely adopted for the lighting of railway carriages,



GASWORKS FITTED ON WHITE STAR LINE CELTIC, 1873.

the gas being made from vaporized oil, by an ingenious apparatus, which was placed just off the engine-room, and occupied about 1600 cubic feet of space.

This was designed and manufactured by Porter



STERN OF BRITANNIC, AS ORIGINALLY FITTED WITH LOWERING PROPELLER, 1874.

and Co., of Lincoln, the first steamer fitted being the **Adriatic** in 1872, followed afterwards by the **Celtic** in 1873. The general effect in the saloon, where there were thirty jets, and in the emigrant accommodation when the whole was lit up, was much admired, being a marked contrast to the candles then customary. Considerable trouble was, however, given by failure of the pipes through the working of the ship at sea, and other causes, allowing leakage, and it was eventually abandoned for the mineral oil lamps.

Another attempt to surmount the trials of the "rolling forties," was the adoption of oscillating state-rooms and berths to counteract the motion in a sea-way, but this, like the more colossal experiment afterwards made on the **Bessemer**, was abandoned, being utterly ineffectual.[1]

An important effort to advance further afield in marine engineering was made by the adoption on the **Britannic** of a system of raising and lowering the propeller, so that the shaft could be lowered when in deep water till it almost touched the keel, and so allow the propeller to work in more solid water, and be less liable to race when pitching in a heavy sea. To attain this object very great alterations had to be made in the arrangement of the stern, so as to allow of a hollow recess in the hull in which the after length of the shafting could move up and down,

[1] The oscillating saloon of the **Bessemer** was 70 feet long by 30 feet broad and 20 feet high, and the hull 350 feet by 45 feet broad There were two sets of engines driving four paddle-wheels. She was launched on September 24th, 1874, and cost over £200,000, but being a failure, was sold August 1876 for £40,000 to break up.

swivelling from a universal joint, connecting with the tunnel shafting.

The machinery was so placed in the ship as to rake very much aft, in order to have the whole of the shafting in a straight line when the propeller was working in its lowered position at sea. After a trial extending over some months, the results were not found so satisfactory as had been hoped, or as the working of smaller vessels had previously indicated, so that it was done away with at considerable expense.

Like some of the other large Transatlantic lines the White Star has not confined itself to the one service, but has widened its connections to such an extent that the well-known cream-coloured funnel and graceful hull may be found floating on all waters of the "great sea."

In 1872 a service from Liverpool was commenced by this line to the west coast of South America through the Straits of Magellan, the first vessel being the **Republic**, which was taken off the Liverpool and New York route, and was at that time by far the fastest and finest boat which was seen in the southern seas. She was followed by the **Asiatic** and **Tropic** in 1872, two boats bought on the stocks in a Liverpool shipbuilding yard, and later by the first **Belgic** and **Gaelic** in 1873, from Harland and Wolff.

Upon her return from the first voyage, the **Republic** was again put on the New York service, and after carrying on the South American trade for a short time, the **Asiatic** and **Tropic** were sold, and the first **Belgic** and **Gaelic** put on the London and New York service, until they were sent on the China and San Francisco route.

In 1875 an important service was formed on the Pacific between San Francisco and China and Japan, on which the **Coptic**, **Doric**, and second **Gaelic** still continue.

This Pacific route was organized by the Oriental Steamship Company to compete with the Pacific Mail Company, an American line which had existed for some time, and employed paddle-wheel vessels having the huge walking beam visible above the deck, as in the American river-boats.

Another extension was the direct Royal Mail service to New Zealand, which is carried on in conjunction with the Shaw, Saville, and Albion Line, the vessels being named **Gothic**, **Delphic**, and **Ionic**. This now important service was first inaugurated by the New Zealand Shipping Company in 1883. The pioneer steamers, which were under the author's superintendence, were the **British King** and **British Queen**, steel vessels chartered from the British Shipowners' Company, of Liverpool. These vessels, by Harland and Wolff, were 410¼ feet long, 39 feet broad, 29 feet deep, and of 3412 tons, each having four-cylinder compound tandem engines by Jack and Co., of Liverpool, with two high-pressure cylinders, each 28 inches diameter, and two low-pressure, each 60 inches diameter, the stroke being 4½ feet. Steam at 90 lbs. pressure was generated in three boilers having eighteen furnaces, the speed being twelve knots on a consumption of 38 tons per day.

The success of the first vessels was so great, that it was not until 1881 that it was found necessary to further increase the fleet, and in that year the **Arabic** and **Coptic**

R.M.S. BRITISH KING (1881).

Pioneer of the direct New Zealand Royal Mail Service, 1883.

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R.M.T.S. TEUTONIC (1889) AND MAJESTIC (1890). WHITE STAR LINE.

[To face page 103.

came out, followed afterwards by the second **Belgic** and **Gaelic** in 1883, all from the Belfast yard.

After this there was another cessation until 1889, when the first vessel to form a real connection between the Royal Navy and the "great fleet messengers of the Mersey" came out. The now well-known twin-screw vessel, the **Teutonic**, and her sister the **Majestic**, which were 566 feet long, $57\frac{3}{4}$ feet broad, $39\frac{1}{2}$ feet deep, and of 9984 tons, were built by Harland and Wolff. These stately ships, although of the same substantial construction and excellent arrangements as the first vessels brought out by this Company, presented a different external appearance. The four masts were replaced with what may be termed three flag-poles, the partial abandonment of sail-power initiated by the Inman and International Line being carried still further; the two funnels were spaced so far apart as to allow the saloon being placed between them, which the great length of the vessel allowed to be done uniformly with the masts.

The first sailing of the **Teutonic** was on August 7th, 1889, upon her return from the review of the British Fleet at Spithead held early in the same month, at which event she was the first Atlantic liner to figure as a fully armed and equipped cruiser.

The first sailing of the **Majestic** was on April 2nd, 1890, since when both of these favourites have kept up a regular service, without any notable event.

During their first few years they contested with the then **City of New York** and **City of Paris** for the record passages (see Table 2), until the coming of the Cunard

Campania in 1893, which surpassed all previous records (page 43).

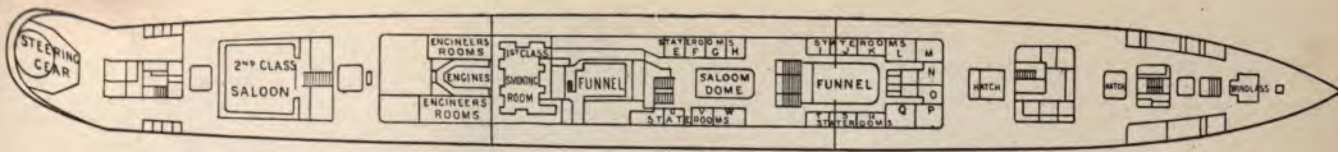
After an interval of seven years (during which period several large cargo and cattle boats were brought out) another addition to the Express passenger service was decided upon, as it was plainly evident that the **Britannic**

UPPER SALOON, R.M.S. OCEANIC.

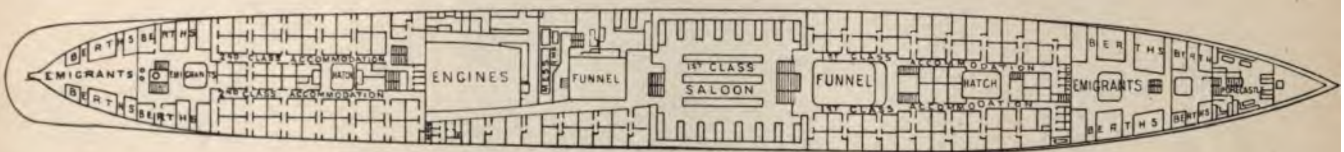
and **Germanic** were no longer large enough or fast enough, although the latter vessel had in 1895 been fitted with new triple-expansion machinery and boilers.

As usual with this line, the order for the new vessel was placed with Harland and Wolff, and the favourite name of **Oceanic** decided upon.[1] She sailed on her first

[1] See Frontispiece.



Upper Deck.



Main Deck.

Lower Deck.

DECK PLAN OF THE TEUTONIC (WHITE STAR LINE).

[*To face page* 105.

voyage on September 6, 1899; the number of passengers being 1500 of all classes, which with crew made the large number of 2000 lives on board. One remarkable feature of this new craft is that she is the first vessel launched since the **Great Eastern** in 1858, which has exceeded her in length, but although longer, it will be observed from the relative table of the respective dimensions of some recent liners, that the **Oceanic** is yet considerably smaller—

	Length over all.	Length B.P.	Breadth.	Depth.	Gross Tonnage	Displacement, Tons.	Draught.	I.H.P	Speed.
	feet								about
Oceanic . .	704	685	68·3	49·	16,900	26,100	28	29,000	21½
Great Eastern .	691	680	82·8	48·2	18,915	32,100	28	11,000	13
Kaiser Wilhelm der Grosse	648·6	625	66	43	14,349	23,760	28	31,000	22¾
Deutschland .	690	666	66·5	45·5	14,900	24,500	28	36,000	23

The general outline and arrangements are somewhat after the **Teutonic**, but elaborated and improved as experience pointed out and the increased space permitted.

The twin-screw system of propulsion has been adopted with machinery of the four-crank triple-expansion type, indicating in the two sets (port and starboard) of engines combined upwards of 29,000 horse-power.

It is to be regretted that the designed speed is not as great as was hoped, for on this account the blue ribbon of the Atlantic still remains with a foreign flag, as, since October 1897, this honour has belonged to the German steamer **Kaiser Wilhelm der Grosse**, which attained the highest speed per hour at sea, and the fastest passage all the way across.

Even with this vessel's success the German lines are not satisfied, as the competing German Line (Hamburg-American) is reported to have placed an order for a still higher speed craft, which, if the inspired announcements be correct, is to have still greater indicated horse-power, as may be noticed later.

If this increasing of power and speed be kept up by Companies heavily subsidized by their Governments, it is but natural that the English Government should be called upon also to substantially subsidize, for although up to date private enterprise has always proved itself ready to lead the van, this must come to an end when the first cost and up-keep becomes so great as to swallow up dividends.

On the other hand, following up the principle of maintaining the most powerful navy afloat, it should be seen to that **no** merchant armed cruisers of higher speed than British should be available, if there is any value at all to be placed in these vessels for such a purpose, and if so, now is the time for State aid to be given in a speedy and substantial form.

Returning to the progress of the line, the year 1888 saw another important advance by the inauguration of a superior service of freight and cattle vessels between Liverpool and New York, which was commenced by two single-screw vessels named the **Cufic** and **Runic**, also built by the Belfast firm. These were followed at intervals by others fitted with twin-screws, amongst which may be mentioned the **Naronic**, which, after sailing from Liverpool on February 11th, 1893, was never heard of again. To replace her, still larger crafts, named the **Cevic**, **Georgic**,

and **Cymric**, were added, and in the latter, built early in 1898, accommodation for saloon passengers has been fitted to a limited extent. In August of that year another trade was commenced between Liverpool and Australia direct round the Cape of Good Hope. The steamers are twin-screw and fitted for third-class passengers only, their names being **Afric**, **Medic**, **Persic**, and **Suevic**. In addition to these, other steamers are building at Belfast, one of which is to be 19,000 tons gross, and be named the **Celtic**.

It may be interesting to mention that the now extensive trade of carrying live cattle across the Atlantic and other oceans was commenced in July 1874; the first steamer to bring cattle to Liverpool from the continent of North America was the **European**, belonging to H. N. Hughes and Nephew, with 373 head of cattle, out of which three were lost; the next vessel, the **San Marcos**, in July, 1875, with 276 head, all for the firm of George Roddick. The dead meat trade by refrigeration commenced on the Guion Line's **Wyoming** in October 1875, a few small lots having previously been successfully carried in 1874 on the White Star liners **Celtic** and **Britannic**.

Unlike the other Transatlantic lines the proprietary of the White Star has undergone no change, the well-known names of Ismay, Imrie and Co. (joined by Mr. W. S. Graves in 1881, and the two sons of the senior partner in 1891) still continuing to steer its course in the same enterprising manner as from the commencement.

The following report, condensed from a Liverpool daily paper of March 18th, 1887, explains the arrangement and

terms then made by the Government with the Cunard and White Star Lines:—

"The Oceanic Steamship Company—

"1. Undertake to hold at the disposition of the Government, for purchase or hire, at the option of the Admiralty, to be exercised from time to time during the continuance of the agreement, the following vessels, viz.:—**Britannic**, £130,000; **Germanic**, £130,000; **Adriatic**, £100,000; and **Celtic**, £100,000.

"2. In the event of purchase, the foregoing prices are to be held as the values of the vessels on the 1st January, 1887, plus ten per cent. for compulsory sale, less an abatement of 6 per cent. per annum on the depreciated annual value for the period that may elapse between the 1st January, 1887, and the date of purchase by the Government. In such case the Company shall be entitled to remove from the ship or ships the plated ware, cutlery, crystal, earthenware, blankets, counterpanes, and linens, which articles are not to be considered as part of the equipment of the ships; such proportionate quantities, however, as may be necessary for the number of officers and warrant-officers that would form part of the ship's complement, if used as an armed cruiser, to be left on board free of charge.

"3. In the event of charter by the Admiralty the rate of hire of the before-named vessels, all or any, to be at the rate of 20*s.* per gross registered ton per month, the owner providing the crew, or at the rate of 15*s.* per gross registered ton per month, the Admiralty finding the crew, all risks of capture and of hostilities being assumed by the Admiralty.

"The offer of the Cunard Line is contained in a letter by Mr. John Burns, dated 8th February. He offered for sale or hire the following vessels:—**Etruria**, of 7718 gross tons, value £310,000; **Umbria**, 7718, £301,000; **Aurania**, 7269, £240,000; **Servia**, 7392, £193,000; **Gallia**, 4809, £102,000.

"The terms of the subvention and purchase are similar to those agreed to by the White Star Line, but for the

charter of the first three vessels the demand is 20*s.* per ton register per month without crew, and the other two 15*s.* per ton per month without crew. In the event of the Company determining to build new ships for the mail service, they undertake to submit the plans to the Admiralty, with a view to their being constructed in a manner best suited for the purpose of armed cruisers."

CHAPTER VII.

DOMINION, AMERICAN, STATE, WARREN, WILSON, AND BEAVER LINES.

In 1872 the Dominion Line commenced between Liverpool, Quebec, and Montreal; this was an offshoot of the Liverpool and Mississippi Steamship Co. trading between Liverpool and New Orleans, which was first commenced in 1870 with a steamer named the **St. Louis**, which was followed by other vessels named the **Memphis, Vicksburg,** and **Texas.**

Upon the Canadian trade being started larger steamers were added, named the **Dominion, Ontario,** and **Quebec,** and a few years later, under an arrangement with the Allan Line, they commenced to carry the Canadian Royal Mails alternately.

In 1883 two fine vessels were ordered from the Clyde, but only one, the **Vancouver**, came into the service, as the other was sold to the Inman Line upon the stocks, and named the **City of Chicago.**

Following the **Vancouver** came the **Labrador** in 1891 from Harland and Wolff's, and about this time the service between Bristol and Canada was commenced.

In 1894 the promoters, Flinn, Main, and Montgomery,

retired, and the Liverpool business was taken over by Richard, Mills and Co., and the Bristol Service by Elder, Dempster and Co., and after this event considerable developments took place on both routes. Orders were placed with Harland and Wolff for high-class twin-screw boats, which were to open up a passenger service to Boston fully equal to that of New York so far as internal fittings were concerned. The first of these boats, which came out in 1896, was named the **Canada**, and was a fine steel twin-screw craft, with one funnel and two pole-masts. Following her came the **New England** in 1898, also from Harland and Wolff, which was by far the finest passenger vessel ever seen in Boston. In order to still further develop the traffic, another huge steamer to be named the **Commonwealth** is now building by this Belfast firm.

Besides these steamers a superior service is also carried on to the St. Lawrence, and in the Bristol trade Elder, Dempster and Co. have substituted fine modern crafts with all the latest improvements for an extensive freight trade. In the summer of 1899 a contract was fixed for the fastest of these vessels to carry the Royal Mails to Canada.

From the failure of the Collins Line and the others noted, down to the year 1871 no efforts were made by the United States to establish an American Transatlantic line, but in that year steps were taken in Philadelphia, and an order placed with Messrs. Cramp, of that city, to build four iron screw-steamers each 343 feet long, 43 feet broad, 34½ feet deep, and of 3119 tons, brig-rigged, with vertical two-crank compound engines, having cylinders 57 and 90

inches diameter, with a stroke of 4 feet, and boiler-pressure of 60 lbs.

These vessels, named the **Ohio, Indiana, Illinois**, and **Pennsylvania**, were fitted with first-class passenger accommodation, and, in conjunction with other English steamers named **Lord Gough, British Prince**, etc., carried on the American Line between Liverpool and Philadelphia from its commencement with the **Pennsylvania** early in 1873, until 1894.

It is interesting to note that it was on one of these steamers the now well-known system of Howden forced draught was introduced to the Atlantic trade; this was fitted to the steamship **Ohio** in the year 1887, when she had new triple engines and new boilers, which resulted in a great addition to her earning space. These four steamers, **Ohio, Illinois, Indiana**, and **Pennsylvania**, were the only regular liners on the Atlantic to fly the American ensign from 1858 until 1892, owing to the United States law which then prohibited any vessel to sail under it unless actually constructed in the country. They were distinguished by the white keystone on their red funnels, this being the badge of Pennsylvania, the Keystone State of the United States.

The service from Philadelphia to Liverpool was carried on with these boats in a fairly successful way for a time, but about 1880 only indifferent financial results were obtained, and eventually in 1884 they were taken over by the International or Red Star Line (page 132).

The new owners removed the cabin accommodation and continued them in the cargo service until 1893, when the

new **American Line** already noted (page 68) took them over, and changing the funnels to black with white stripe and the red flag with keystone to white with blue spread-eagle, continued to sail them until the end of 1897, when they were sold for service on the Pacific coast of America.

In 1894, to improve the Liverpool and Philadelphia service, the International Navigation Co. or American Line ordered two twin-screw vessels, with moderate saloon accommodation, from Clyde builders. These were named the **Kensington** and **Southwark**, after two Philadelphia suburbs, and continued on the service until the spring of 1895, when they were removed to the Antwerp New York line, and the other vessels, named the **Belgenland**, **Rhynnland**, **Pennland** (formerly the Cunard **Algeria**), and **Waesland** (Cunard **Russia**), were put on the Liverpool and Philadelphia service. Owing to this move there exists the strange anomaly of a fleet under the Belgian flag sailing from an English port, and it is also worth noting that the two old Cunard vessels, **Russia** and **Algeria**, sail from the port of which they were once crack vessels. Late in 1898 an order was placed with the Clydebank firm to construct two fine twin-screws for this service, the tonnage of which will be between 9000 and 10,000, and the speed about twelve knots.

In addition to the foregoing changes, the American Line (officially the International Navigation Co. of New Jersey) became prominent through the purchase of the "Inman" Line, and later by the absorption of the "Inman and International" with their famous **City of New York** and **City of Paris**, already noticed (page 65).

The first sailing of these steamers under their new names, **New York** and **Paris**, and on the new station, took place on March 4th, 1893, when the **New York** sailed from Southampton for New York, and they have since continued on that service. At first it was carried on in conjunction with the **Berlin** (formerly Inman **City of Berlin**) and the **Chester** (late **City of Chester**), but later on the two vessels, **St. Paul** and **St. Louis**, which were built at Philadelphia by Cramp to comply with the laws of that country, took their places.[1]

The first of these fine sisters was the **St. Louis**, which was launched on the Delaware on November 12th, 1894, and sailed for Southampton direct on June 5th, 1895. The **St. Paul** was launched in March 1895, after a slight mishap caused by sticking on the ways.

It will be seen from the illustration (opposite) that they are somewhat after the usual type of Express Liners, so that an elaborate description of them is unnecessary. The hulls measure 554 feet over all, and 535·7 B.P., 63

[1] In April 1898, on outbreak of war between Spain and America, the four vessels of the American line, **St. Louis, St. Paul, Paris,** and **New York,** were taken over by the United States Government and fitted as cruisers. The name of the Paris was changed to that of the **Yale,** and the **New York** to the **Harvard,** the last sailing from Southampton being the **Paris,** which left for New York on Friday, April 22nd, and the passage was keenly watched by the public lest she should fall across the Spanish cruisers. After the cessation of the war in the autumn of the same year they were given up by the United States Government, and returned to the Southampton and New York route under their original names. During the continuance of the war, the United States Government purchased the **Berlin** and **Chester,** which ended their careers on the "Ferry."

ST. LOUIS AND ST. PAUL (1895). AMERICAN LINE.

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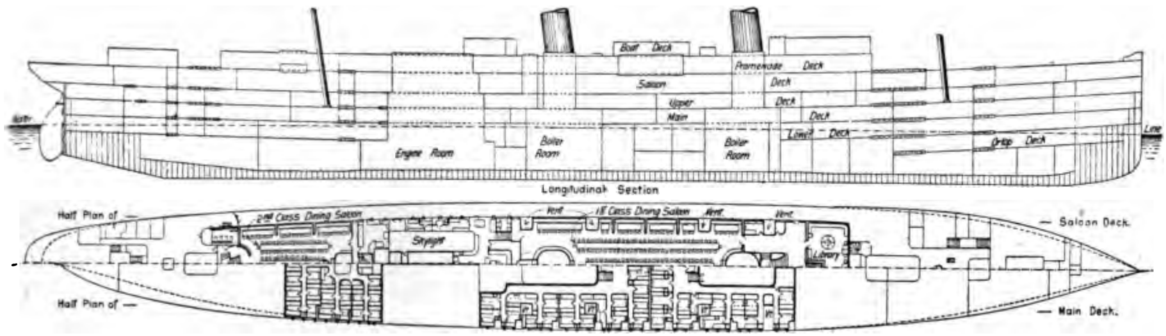


LONGITUDINAL SECTION AND PLANS OF THE ST. LOUIS.

[To face page 115.

feet beam, and 42 depth of hold, the gross tonnage being 11,629, and the displacement 16,000 tons.

The twin-screw propellers are arranged as on the **Teutonic** and **Campania**, and driven by two separate sets of quadruple expansion engines, each set having six cylinders working on to four cranks, the two high-pressure, each 28½ inches diameter, being placed tandem fashion on top of the two L. P. (each 77 inches diameter) which work on the two forward cranks; the second expansion cylinder (77 inches diameter) works on the third crank, and the first expansion cylinder (55 inches diameter) on the fourth crank. The stroke is 5 feet, and boiler-pressure 200 lbs., generated in six double and four single-ended boilers, having 64 furnaces in all, worked under forced draught, and under ordinary circumstances a sea speed of twenty knots can be maintained.

Owing to the charges in the United States for labour and materials being higher than in Great Britain, the cost of these two fine vessels has been much increased over that of the vessels of the British lines; taking a moderate estimate of about 20 per cent. more all round, the actual cash value when new may be put down at £730,000 for each vessel, that is £1,460,000 in the two, which is still more remarkable when it is remembered that the vessels have nearly 10 per cent. less tonnage and 33 per cent. less indicated horse-power than the Cunard **Campania.**

Since their coming this pair of Atlantic Argosies have become well favoured, and given a decided stimulus to the Southampton route, as well as further increasing the great current of saloon passengers who come and go on

the "Ferry." The average speed is recorded as being about twenty knots, which represents an average passage of five days, twenty hours on the Queenstown route; but on several occasions the passage has been made at the rate of a little under twenty-one knots per hour.

When it is remembered that from the commencement it was not intended to surpass the Cunarders, this speed must be considered satisfactory, and were it not for the stranding of the **St. Paul** off Long Branch in January 1896, where she remained for a few days, and the stranding of the **Paris** on the Manacles Rock, Cornwall, on May 20, 1899, where she remained until the following July, no event happened to interrupt the excellent service carried on, except when the four vessels were taken by the American Government to serve as cruisers during the war commenced with Spain in April 1898.

In 1873 a venture which struggled to keep a place upon the Atlantic highway was formed in Glasgow to trade from that port—and occasionally from Liverpool—to New York, under the name of the State Line. This continued to ply, calling at Larne (Ireland), until early in the year 1891, when it collapsed, the steamers passing into the hands of the Allan Line to swell their already enormous fleet.

In the same year, 1873, the South Wales Atlantic Steamship Company was formed to run from Cardiff to New York, but only lasted two years, notwithstanding that they had no dock dues to pay at Cardiff and were supplied with coal gratuitously by the Marquis of Bute, who was one of the largest shareholders in the line. The

two steamers were named **Glamorgan** and **Pembroke**, and were fitted up in superior style; the former was lighted with Allan's patent gas apparatus, which, like the vessels, was unsuccessful.

The next expansion of this great trade was made in 1874 from Bristol, the port which first created and carried it on. This was made by a company called after the one which originated the enterprise, namely the Great Western, which carried on a moderate freight and cattle service until 1896, when it ceased.

The year 1875 also saw the birth of another Liverpool line of steamers named the Warren Line, which commenced a steam service to Boston by the purchase of the Guion Line pioneers, **Manhattan** and **Minnesota**. These they had fitted with new compound engines, and then placed them on the station for their freight and cattle service early in the year noted, and since then it has gradually expanded and added some fine freight and cattle steamers to their line.

In February of the same year, 1875, another huge trading fleet appeared on the Atlantic, sent forth by the great shipping firm of Wilson, whose already extensive trade from Hull enabled them to command a profitable trade from almost any part of the world. In 1884 they introduced to the Atlantic trade the triple-expansion engines on their steamship **Martello**, a vessel 370 feet long, 43 feet broad, 28 feet deep, and of 3709 tons, with triple engine having cylinders 31, 50, and 82 inches diameter, and 4 feet 9 inches stroke. This service still continues, having been largely increased by a London

connection which was formed, in conjunction with another line, in 1886, to be noticed later.

Another of the existing regular lines, the Beaver, or, more correctly speaking, the Canada Shipping Company, Limited, also commenced in 1875 to change from their fine fleet of iron sailing clippers to the steam service, and had three fine iron steamers named the **Lake Nepigon**, **Lake Champlain**, and **Lake Megantic**. They were built on the Clyde, and continued the service, together with other vessels, until the end of 1894, when the line ceased owing to financial difficulties.

After some negotiations it was revived again in 1895, and came under the management of D. and C. MacIver, formerly of the Cunard Line (page 25). Later, in 1897, having secured the mail contract, they purchased the Cunard Liner **Gallia**, and continued the service until the spring of 1899, when Elder, Dempster and Co. of Liverpool took over the Lake boats, and commenced a Liverpool to Canada service.

CHAPTER VIII.

LEYLAND, JOHNSTON, AND LONDON LINES.

NOTWITHSTANDING the numerous lines already noted, another came upon the scene in 1876 to compete with the Cunard Company for a share of the Boston trade; this important Company, now known as the Leyland Line, commenced on this service in 1876, but had long been engaged in the Mediterranean trade from Liverpool under the esteemed firm of Bibby, which had retired from the management some years before. To carry on this service the six largest ships of the then existing fleet were placed upon the route, and as they were, so to speak, prototypes of the White Star boats, being built prior to them by the same firm of builders, they were successful, and were soon afterwards fitted with larger compound engines and generally altered to suit them for the wild Atlantic. Since its inauguration the Leyland Line has been most successful, and of late has added fine vessels, as the **Armenian**, **Victorian**, and **Winfredian**, and others, built by Harland and Wolff. Early in 1893, owing to the death of the principal, the line was re-organized as a public

limited company, and in 1896 a further extension took place to form a London connection, which is named the Wilson-Furness-Leyland Line. In 1899 a Liverpool Canadian line was started, and another from Antwerp to a United States port.

In the year 1880 the only regular line from Liverpool

THE BAVARIAN (1868). LEYLAND LINE.

to Baltimore was commenced by the firm of W. Johnston and Co., who were already extensively engaged in the steamship trade to the Danube and other ports. The service is now carried on very extensively with some fine cattle and freight steamers, named **Templemore, Vedamore, Ulstermore**, etc. Another service from London to Baltimore has been carried on since early in 1890 with fine

steamers of the same class. In 1898 another line appeared on the Atlantic Ferry, which was promoted by a Manchester Company, and named the Manchester Liners. The trade was commenced in 1899 between Canada and Manchester direct, the first vessels being the **Manchester Port** and **Manchester City**.

In addition to these lines, there are now very many other occasional vessels engaged trading to and from the various ports of the United States and Canada, which countries may well be termed the great granaries of modern times, owing to the enormous supplies they send to the mother country.

Although the great city on the Mersey still controls almost the whole of the passenger and by far the greater bulk of the freight service of this vast "coming and going" of modern commerce, a considerable number of other freight lines now find location on the Thames, in order to supply direct the teeming mass of humanity centring in the great emporium of the world, London. One of the principal of these was known as the Wilson-Hill Line until the year 1896, when it was again changed owing to amalgamation with Furness and Leyland.

This (Wilson-Hill) line was formed in 1887 to carry on the service between London and New York, which had been known as the Monarch Line, or, more correctly, the Exchange Shipping Company, Limited. This concern was established in 1881 by Patton, Vickers and Co., with a view to carrying on direct from London to New York a regular saloon and emigrant passenger service

combined with cargo, and was commenced with the **Assyrian Monarch** and sister steamers built by the Earle Shipbuilding Company, in Hull, followed afterwards by others built on the Clyde. During the early portion of its career a fairly successful business was carried on, but this gradually fell away, and in 1887 the line collapsed, and the steamers were taken over, as already noted, by the Wilson Line of Hull, and the Allan Line of Glasgow, represented by the line then trading from London, called the Hill or Twin Screw Line.

This latter line (Twin Screw) came into notice in the year 1881 by bringing forward the first twin-screw propelled steamer in the Transatlantic trade. This vessel was named the **Notting Hill**, and was built of steel on the Clyde, her dimensions being 420 feet long by 45 feet broad, 26½ feet deep, and of 3920 tons, and was followed afterwards by others of similar dimensions and construction.

Although fitted with limited passenger accommodation, they were not designed for what is now generally known as the Express Transatlantic Service—their speed only averaging about twelve knots per hour.

The engines were of the compound tandem type, but had only one crank-shaft and one set of cylinders for each (port and starboard) engine, the diameter of each high-pressure being 32½ inches, and of the low-pressure 76 inches, with a stroke of 4 feet.

In 1883 this vessel's career was suddenly terminated by striking an iceberg in the month of February, but fortun-

ately without loss of life. Owing to the formation of the Wilson-Furness-Leyland Syndicate, the other vessels were sold in 1897,—or rather bought in by the Allan Line and taken off the London service,—and having been overhauled and their names changed, they now sail in that large fleet which has services from London to Philadelphia, Baltimore, River Plate, and elsewhere.

In 1896 the Wilson-Furness-Leyland Line took over several services, and put on vessels to New York, and new steamers named **Boadicea**, **Alexandra**, and **Winifreda** to Boston. In June 1898 the latter and other vessels were sold to the Atlantic Transport Line, and the New York service given up. Other lines are the Furness, trading to Halifax and St. John's, the "Johnston" to Boston, also to Philadelphia, as well as their Liverpool service already noticed, the Philadelphia Transatlantic Line trading to that city under the British flag, the Chesapeake Line to Newport News, the National Line (already noted) to New York, and the Atlantic Transport Line, which controls the National, and has its own services, to New York, Baltimore, and Philadelphia, *viâ* Swansea. In June 1898 all the New York steamers of the Atlantic Transport Line were sold to the United States Government, and this line purchased the whole of the Wilson-Furness-Leyland New York fleet, and changed the names of the steamers, one of which was the unfortunate **Mohegan**, wrecked with great loss of life on the Manacles Rock, Cornwall (see Table 6).

Another line commenced in recent years in the live cattle and freight service is the Donaldson, from Glasgow

to Canadian ports, which commenced with the steamship **Colina** in May 1887 and still continues.

It will perhaps be of interest to give a brief final notice of the once famed **Great Eastern.** Her dimensions were 679½ feet long, 83 feet broad, 48 feet deep, and 18,915 tons, with oscilliating paddle-engines, having four cylinders each 74 inches diameter, and stroke of 14½ feet, and horizontal screw engines, with four cylinders, each 84 inches diameter, and 4 feet stroke, the boiler pressure being 30 lbs., generated in ten boilers, having a hundred furnaces fired athwartships. The career of this colossal structure, commencing with her launch in 1858, was singularly unfortunate, as with the exception of the successful laying of the first Atlantic cable, and a few others, she has never once been a commercial success. As if to add still further to her misfortunes, the last years of her existence saw this once wonderful example of the "much-belauded pet of man's constructive skill" lowered to the level of an advertising medium, and then to be the bugbear of the ports of the kingdom, one port even going so far as to ask Parliament to grant them powers to prevent her floating on the tranquil waters within their precincts.

After a year or two of this degraded existence, she again underwent one of the periodic sales which had occurred almost annually throughout her career, but for the last time, as she was purchased by a firm of shipbreakers for £16,000, and broken up at New Ferry, on the banks of the Mersey, almost in the same year (1890) that the **Great Britain** ended her career at the Falkland

GREAT EASTERN (1858). [To face page 124.

One set of boilers and one funnel, between fourth and fifth masts, were removed for cable-laying purposes.

Islands, representing with the broad gauge on the railway, now also abolished, the last of the costly and bitter memories of the engineer Brunel, who, unfortunately for many, had more influence with great capitalists than other far more capable and less fanciful engineers.

CHAPTER IX.

CONTINENTAL LINES.

TURNING now to the continent of Europe, we find many steamship companies competing for shares of the traffic ever flowing to and fro on the greatest highway of commerce the world has ever known, and which may well be termed the "Nursery of the Steamship," owing to the great achievements in naval architecture and marine engineering which from time to time it has brought forth.

Amongst the largest and most important of these is the well-known Hamburg-American Line, trading from Hamburg and Cuxhaven to New York, calling at Southampton. This powerful Company, like some of the English lines, first commenced the trade with sailing ships in 1847, and gradually developed into steam, their first steamer being the **Borussia**, an iron screw-steamer, built and engined by Caird, of Greenock, in 1855. Her dimensions were 317¾ feet long, 40 feet broad, 28 feet deep, and of 2349 tons; the engines were overhead oscillating geared, with cylinders each 67 inches diameter, and stroke of 6 feet. This pioneer vessel started on her first voyage on June 1st, 1856, and was followed by a sister ship named the **Hammonia**, which two steamers kept up the service, in conjunction

with the sailing vessels until the year 1860, when the latter were disposed of and more steamers added. In April 1875 it absorbed the opposition Hamburg Company known as the Eagle Line, and has since developed into an extensive concern, sending its steamers east and west, and possesses, besides an ordinary moderate speed passenger service to New York, an express service, with its modern twin-screw steel boats of the finest type.

Two of these vessels were named the **Columbia** and **Normannia**, and were sold to the Spanish Government in the spring of 1898 for £450,000, and were re-named the **Rapido** and the **Patriota**. Two others, the **Augusta Victoria** and the **Fürst Bismarck**, were built by the Vulcan Company, at Stettin. The sizes of the ships and engines are as follows—

Columbia, 463½ feet long, 55½ feet broad, 35½ feet deep, and of 7363 tons. Triple engines, cylinders 41, 66, and 101 inches diameter, with 5½ feet stroke.

Auguste Victoria was lengthened 60 feet in 1896, and now measures 520 feet B.P., 55¾ feet broad, and 33·8 feet deep, and of 8668 tons gross. Triple engines, cylinders 41, 67, and 106 inches diameter, with 5¼ feet stroke.

Normannia, 500 feet long, 57½ feet broad, 38 feet deep, and of 8250 tons. Triple engines, cylinders 40, 67, and 106 inches, with 5½ feet stroke.

In 1899 the **Normannia** was purchased from the Spanish by the French Compagnie Transatlantique for their New York Express Service, and re-named **L'Aquitaine**, and in the same year the **Columbia** was bought back by the Hamburg-American Line.

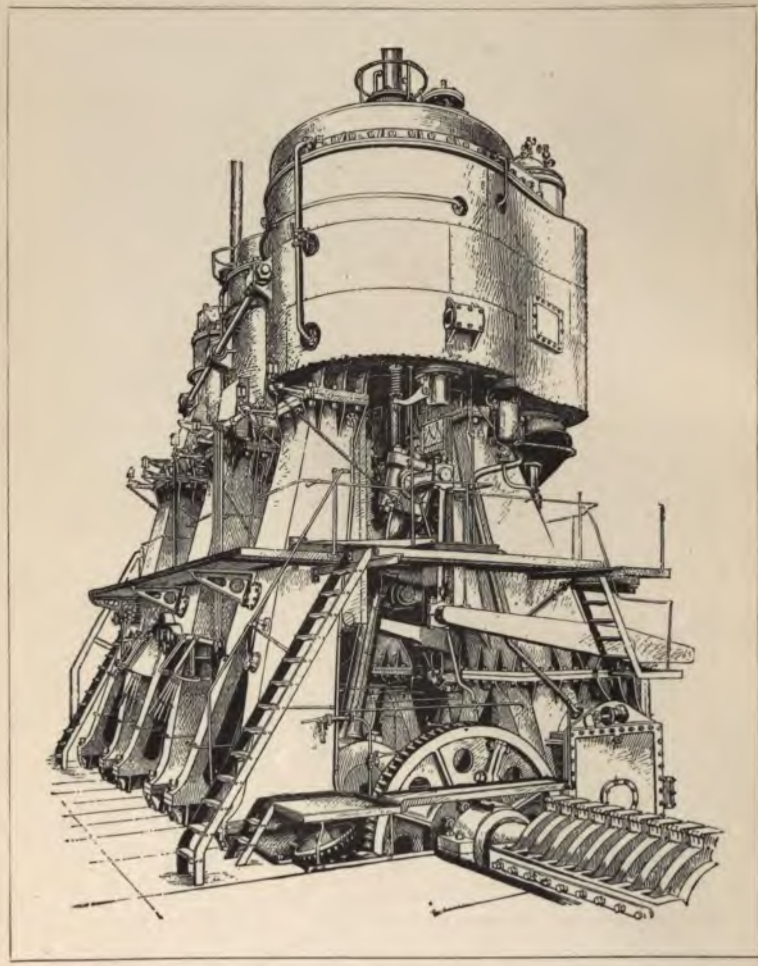
Fürst Bismarck, 502 feet long, 57½ feet broad, 38 feet deep, and of 8874 tons. Triple engines, cylinders 43, 67, and 106¼ inches, with 5¼ feet stroke.

Like the old Inman and International Line vessels, this fine quartette adopted the three funnels, and abandoned the use of sail-power, and made the passages between Southampton and New York under seven days, taking about eight days to and from Hamburg.

Later on, in 1895, this line gave extensive orders to Harland and Wolff for huge twin-screw vessels having moderate speed, for combined passenger (saloon and steerage), freight, and cattle trade, and of these, one, named the **Pennsylvania**, was in 1896 the largest vessel then afloat. In May 1898 it was announced that an order had been placed with the Vulcan Company of Stettin, for another large high-speed boat, to be named the **Deutschland.** The dimensions of this craft are reported to be 690 feet long over all, and 666 B.P., by 66·5 broad by 45·5 deep, with a gross tonnage of over 14,500 and displacement of 24,400 tons. The indicated horse-power is to range about 36,000, with quadruple six-cylinder four-crank engines; steam is to be generated in 14 boilers, having 104 furnaces working under forced draught. Judging by these particulars, it is evident that the records of the Atlantic Ferry will be once more broken early in 1900.

The other important German line is that known as the Norddeutscher Lloyd from Bremen, which was founded in 1856 by a Bremen citizen, Herr H. H. Meier, who succeeded in amalgamating the various steamship companies, coasting and otherwise, then existing, and forming

ALLER (1885). FIRST EXPRESS ATLANTIC STEAMER WITH TRIPLE ENGINES. [*To face page* 128.



ENGINES OF THE ALLER. [*To face page* 129.

out of them this great Company. It was practically constructed in February 1857, and commenced the Transatlantic service in June 1858, with the screw-steamer **Bremen**, 318 feet long, 40 feet broad, 26 feet deep, and of 2674 tons, with inverted direct-acting engines, having cylinders 90 inches diameter, and 3½ feet stroke, indicating 1650 horse-power. She was built by Caird and Co., of Greenock, together with three others, named the **New York**, **Hudson**, and **Weser**.

Since this event a regular trade has been carried on, and many vessels added to the Norddeutscher fleet from time to time; in 1862 and 1863 the **Hansa** and **America**, followed by the **Hermann**, **Deutschland**, and **Union**, all built by Caird and Co.

In 1868 a weekly service was commenced from Bremen to Baltimore, and since then extensive offshoots have been created to the most distant parts of the globe.

In 1881, under the spirited management of Herr Lohmann, the then managing director, new 17½-knot express steamers, named the **Elbe**, **Werra**, and **Fulda**,[1] each 438 feet long, 48 feet broad, 34·6 feet deep, and of 5400 tons, by Elder and Co., were placed upon the New York service, and were followed afterwards by the 18-knot **Aller**, **Trave**, and **Saale**, in 1885 and 1886, which were single-screws, and had the first triple-expansion engines in the Express Service (although not the first on the Atlantic, as already noted), the diameter of cylinders being 44, 70, and 108 inches respectively, with a stroke of 6 feet, and of 8200 indicated horse-power. Since then

[1] See pages 132 and 261.

has appeared the **Lahn**, 19 knots, of slightly larger dimensions, from the Fairfield Shipbuilding Company, having triple engines with two high-pressure cylinders, each 32½ inches, one intermediate, 68 inches diameter, and two low-pressure, each 85 inches, with stroke of 6 feet, and indicating 9500 horse-power; also in 1890 and 1891, from the Vulcan Shipyard at Stettin, the **Spree** and **Havel**, two fine vessels, 463 feet long, 52 feet broad, 34 feet deep, and of 6963 tons, with triple engines of slightly larger power. In 1898 the **Havel** was sold to the Spanish Government, and in the same year the **Spree** was lengthened to 528·4 feet, and converted into a twin-screw, with new engines, having 8 cylinders, two of 43⅓, two of 67, and four of 77, with 63 inches stroke, and the name was altered to **Kaiserin Maria Theresa.**

After an interval of five years an order was given to the Vulcan Shipbuilding Company at Stettin early in 1896 for the largest and most powerful liner, the **Kaiser Wilhelm der Grosse**, which had then been on the Atlantic Ferry. This noted craft was launched on May 4th, 1897, and sailed on her first voyage from Bremen to New York on September 19th that year, and maintained an average speed outward of 21·4 knots per hour, and 21·9 on the homeward, which corresponds to a passage of 5 days, 10 hours, 50 minutes between Queenstown and New York, and 5 days, 9 hours, 40 minutes homeward.

The dimensions are 648·6 feet over all, 625 B.P., by 66 feet beam, 43 deep, and a gross tonnage of 14,350. This vessel and the s.s. **Kaiser Friedrich** were the first powerful

KAISER WILHELM DER GROSSE (1897). NORDDEUTSCHER LLOYD LINE.

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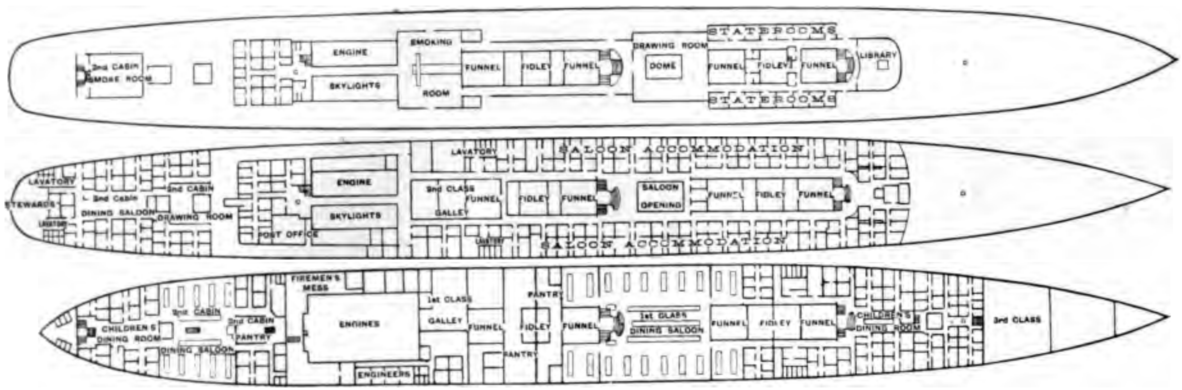


DECK PLANS OF KAISER WILHELM DER GROSSE.

[*To face page* 131.

twin-screw vessels which this line placed on the Atlantic service, although they had other smaller twin-screw boats in their Australian trade. The general appearance of the **Kaiser Wilhelm der Grosse** is very imposing with two masts and four funnels, and the impression of possessing enormous power is forced home, and the great height of side out of the water tells of itself the enormous size of the hull. The saloon quarters are of a most elaborate and handsome description, designed to accommodate 400 passengers.

As she was built to attain great speed, the machinery is of the most powerful triple-expansion type, having four cranks with one high-pressure cylinder 52 inches, one intermediate 89½ inches, and two low-pressure each 96½ inches diameter, all having a stroke of 5 feet 9 inches. Steam is generated in 14 boilers at 178 lbs. pressure, and a consumption of 520 tons per day is required to feed the 104 furnaces. The weight of the boilers alone with water is but little under 2000 tons, and of the whole machinery over 7000 tons. The cost of this fine boat was about £700,000, which means an enormous income to render her a profitable boat.

The vessels of the North German Line maintain a bi-weekly service to New York, leaving Bremen and New York every Wednesday and Saturday, calling at Southampton; also a weekly service to Baltimore, leaving Bremen and Baltimore each Wednesday. To enable them to carry on this great trade and the other branches, the Company own an extensive sea-going fleet, besides numerous smaller craft, and also possess their own graving

and other docks, together with extensive works for the overhaul and maintenance of their fleet.

During the present decade, this line has received heavy blows by the stranding of the **Eider** on the Isle of Wight (January 1892), and the total loss of the **Elbe** in January 1895, which was struck by a small steamer off the coast of Norfolk, and sunk in a few minutes, with a loss of 335 lives.

One of the principal lines doing an extensive business from Europe direct is that officially termed the Société Anonyme Belge-Américaine, but better known as the Red Star Line, from Antwerp, until 1893, when it was merged into and is now known as the American Line, but still retaining its official title. This extensive service was commenced by the iron steamship **Vaterland**, 320½ feet long, 38½ feet broad, 31 feet deep, and of 2748 tons, with two-crank compound engines, having cylinders 40 inches and 80 inches diameter, and stroke of 3½ feet. She sailed from Antwerp on January 19th, 1873, for Philadelphia, and was followed afterwards by the **Nederland** and **Switzerland** in 1873 and 1874.

It is interesting to note that these vessels, which were built and engined by Palmers of Jarrow, were the first ever built to carry petroleum in bulk, in which an extensive trade to Antwerp was then commencing. As, however, the passenger trade was also carried on by these vessels, the carriage of petroleum, owing to the restrictions of the supervising authorities, was not proceeded with.

Owing to the continued expansion of their trade, other vessels were soon added to the Red Star fleet, the **Belgen-**

KAISER FRIEDRICH (1898). NORDDEUTSCHER LLOYD LINE.

[To face page 132.

VATERLAND (1873). FIRST STEAMER OF RED STAR LINE.
First steamer specially built for carrying petroleum in bulk.

[*To face page* 133.

land in 1878, and **Rhynland** in 1879, built by the Barrow Shipbuilding Company, and later by the **Zeeland**, **Waesland**, and **Pennland**, which under the respective names of the **Java**, **Russia**, and **Algeria** were previously known in the Cunard fleet. Following them came two fine vessels, the **Westernland** and **Noordland**, from the yard of Laird Brothers, Birkenhead, in 1883.

In 1889 an addition was made to the fleet by J. and G. Thomson, of Glasgow, who built a single-screw steel steamer named the **Friesland**, 430 feet long, 51¼ feet broad, 35 feet deep, and of 6800 tons, with triple-expansion engines, having cylinders 35½, 56, and 89 inches diameter, and with a working pressure of 160 lbs. Towards the latter part of 1898 an order was placed with the Clydebank firm for two large twin-screw steamers for this service, each to have good speed, and measure about 12,000 tons, and in addition it is proposed to have four even finer and faster vessels built in the United States.

With this fleet a regular weekly first-class passenger and emigrant service is carried on to New York, and a secondary one fortnightly to Philadelphia.

Of the Transatlantic lines trading from France, the most important is the Compagnie Générale Transatlantique, which commenced to run from Havre to New York in 1864 with iron paddle-vessels named the **Washington**, **Lafayette**, **Impératrice Eugénie** and others, built by Scott of Greenock. They were 343·3 feet long by 43·3 broad and 30·2 deep, and 3200 tons, with from 2800 to 3300 indicated horsepower, and about 13 knots speed. These were followed later by the **Periere**, called after the enterprising manager

of the line, and the **Napoleon III.**, which later, under the name of **Ville du Havre**, was sunk by collision in 1873, with great loss of life. These two vessels were built by the Thames Ironworks, and were 363·5 feet long by 46 broad and 32·8 feet deep, the tonnage being 3950, and the indicated power from the old side-lever engines reached 3570, with a speed of 13·12 knots, the cost being over £180,000. In 1872 the **Napoleon III.** was lengthened and altered by Maudsley of London from a paddle-vessel to a single screw, and the name changed as already noted. This Company, like the others, gradually increased its fleet and expanded its services, and at present possesses a large number of steamers, which are vessels of moderate size and speed, and were constructed some years ago to maintain a place amongst the other express lines to New York. One of these vessels, **La Normandie**, was built of iron at Barrow, in 1882, with engines having six cylinders, corresponding to those of the **City of Rome**; she was followed by the ill-fated **La Bourgogne**, **La Champagne**, and **La Bretagne**, the two latter being constructed at the Company's own works at St. Nazaire; they were 495 feet long, 52 feet broad, 33½ feet deep, and of 6900 tons, with six-cylinder compound three-crank engines.

In addition to these four vessels, another twin-screw, named **La Touraine**, built at St. Nazaire, was added in 1891, which is 520·3 feet by 56 feet broad and 34½ feet deep, but she has not become noted, and although rumours have been prevalent of coming vessels, nothing has been decided upon as to the class of steamers required in the future.

R.M.S. FRIESLAND (1889). RED STAR LINE.

[To face page 134.

TRANSATLANTIC LINER NAPOLEON III. 1862.

[To face page 135.

In 1899 the old Hamburg-American liner **Normannia** was purchased from the Spanish Government for the New York service, and renamed **L'Aquitaine.**

In July 1898 this line sustained a heavy blow by the sinking of the **Bourgogne** after collision with an English sailing craft off Sable Island, when over 500 lives were lost.

Other French lines trading in the cargo service are the Chargeurs Réunis, Compagnie Commerciale, from Havre, and the Compagnie Bordelaise, from Bordeaux.

From Italy Rubattino's immense fleet keeps up a service between the Mediterranean and New York, as does also the Fabre Line; from Copenhagen the Thingvalla Line, began in 1879, carried on the only direct service from Denmark to New York, until 1897, when it ceased.

This line became noted some years ago through the foundering, in April 1889, of one of their vessels, the **Danmark**, when not a life was lost out of 734 souls on board, all having been rescued by the **Missouri**, of the Atlantic Transport Line from London.

In 1872 the Dutch Line, officially styled the Nederlandsch Amerikaansche Stomvaart Maatschappij, of Rotterdam, but known in this country as the Netherland-American Line, commenced a regular passenger and freight service to New York. By the purchase in 1888-9 of several of the then well-known Liverpool liners, as the **Baltic, Republic, British Empire, British Crown,** and others, they established a service between Rotterdam and New York, changing the names of the steamers to **Veendam, Maasdam, Rotterdam,** and **Amsterdam.**

In 1897 an order was given to Harland and Wolff for a new twin-screw named the **Rotterdam**, which was put on the route in 1897, and followed by a vessel named the **Statendam** in 1898.

Other lines trading across the Atlantic are the Harrison of Liverpool, the Furness, the Philadelphia Transatlantic, and the Dominion of Elder-Dempster from Bristol and London.

The Spanish Compania Transatlantica; also the Bensaude and Andresen Lines, under the Portuguese flag, from Lisbon to New York, calling at the Azores. In August 1899 the Dominion Line of Elder-Dempster and Co. contracted for and carried the Canadian Mails between Bristol and Canada.

CHAPTER X.

THE WORKING OF ATLANTIC LINES.

LIKE the other great organizations formed in the nineteenth century for the use and convenience of man, the ocean steamship companies enter so much into the routine of life, that a brief glance into the manner and means by which the current—or circulation—of the beautiful vessels is kept up is likely to be of interest to many and useful to some.

In considering the subject, it will at once be apparent that it is necessary for the successful working of a Steamship Line that there should be one leading head to guide the entire organization, whether it be under public or private ownership. Acting under him comes the directing staff, which is practically in two separate sections. These may be termed the "Inside" and "Outside" sections.

The "Inside" section comprises the partners, directors, or managers, and, in conjunction with them, the heads of the various departments which are carried on in the office, such as the finance, accountant's, freight (inward and outward), passenger, and oftentimes insurance departments.

To the same section belongs the arrangement and

conducting of the various negotiations, incidental to the general business of the line—such as, the carriage of passengers, freight, and mails; the fixing of the sailing schedules; and the thousand and one details which must be fully worked out with the various connections, scattered throughout the portions of the world in which the line may be directly or indirectly engaged; also arranging with the feeders or carriers, consisting of the various railways and steamboat lines, running more or less in conjunction with them; and also, if they be mail steamers, advising and conferring with the postal authorities, to insure dispatch and regularity in the transmission of the mails and generally the utmost efficiency and safety.

The duties of the various heads of the departments are apportioned to men of great experience in their special line, so that each may be worked to its utmost capacity. The chief of the freight has for his duties the tracing, following up, and securing for his line the carrying of every kind of merchandise, machinery in transit, breadstuffs, dead meat, live cattle, bullion, and so forth, which it is possible to secure. In the passenger branch the same restless energy exists in spreading the great network of alluring advertisements — handsome pictures of the steamers, accounts of fast passages, details of accommodation—by the aid of active agents in every town of the various countries likely to use the watery highway on which the vessels of his line come and go.

The chief of the accountancy department, as the name indicates, has to keep straight the financial concerns of the whole undertaking, commencing at the first great item

of capital account, and going down through the immense number of departments in what may be called the home district, to the smallest transactions of all the branches and agencies in outlying foreign ports.

The more important matters of the line—such as the building of new vessels; the opening up of new services; the regulation of times of sailing; carriage of mails; agreements with governments; arrangements for charter, and such like—are, of course, retained in the hands of the principal and his partners or directors, and nothing is known of them outside until their proceedings are matured and definitely settled. As soon as any new step has been decided upon, the heads of the various departments are called upon to report and to point out the various details requiring development or improvement, each in his own special line, and from time to time proceed to the shipyard and engineering works, and regularly inspect the progress of the work, consulting with the owners and builders as the work advances, with a view of securing the latest and most modern arrangements.

The system by which the whole of the various departments and staffs are engaged in keeping up the working of the steamers is somewhat as follows:—On the arrival of each ship in the home port, the commander reports to the head office the more important events and occurrences of the voyage, and the heads of the three departments—deck, engine, and steward's—return a complete "indent" of the overhauling or work necessary in their divisions to their respective Superintendents. The latter then go into the various matters, satisfying themselves that the work

on the list is requisite, and orders for the work to be carried out are then given to whichever branch of the shore staff it comes under.

At the same time that this overhauling "indent" is handed in, a complete list is furnished of the stores consumed, of the quantity remaining on board, and of what is required for next voyage. This is also scrutinized by the Superintendents, and then passed on to the various officials, to have the articles supplied in good time for the next sailing date. Should there be any extensive or heavy repairs to be effected, or any important alteration to be made, the Superintendent of the department in question then brings the matter forward before the principals, and the details of the work (or, if necessary, the substitution of one vessel for another) are then arranged mutually with the other Superintendents.

In order to insure effective and perfect working, regular fixed meetings of the partners, managers, and superintendents are held, at which the commanders then in port also attend, and the various matters which from time to time require general attention are discussed and arranged, so that each department is kept thoroughly in touch with, and cognizant of the doings of the other. As it is impossible always to define the limits of where one responsibility ends and the other begins, the utility and, indeed, necessity of this system is obvious.

Turning now to the other great section, the "Outside," this, like the "Inside" section, is conducted under the head or chief, with the other partners or managers acting in conjunction with the heads of the engineering, sailing,

and victualling departments which are actually engaged in working the steamers.

The most important is naturally the engineering department, which embraces almost innumerable divisions, for all of which the Superintending Engineer is responsible. It is this department upon which, when a new steamer is about to be taken over from the builders, devolves the duty of arranging the engineering staff on board the vessel. This class ranges from the sailing chief engineer, with his staff of engineers, electricians, and refrigerating engineers, down to boiler-makers, greasers, firemen, and trimmers, and amounts now-a-days to a small army of 220 men in all.

A very important duty is the up-keep and maintenance of the whole machinery of the vessel, not only in the engine department, which alone comprises upwards of fifty different engines, besides the main engines, but also the auxiliary apparatus scattered throughout the vessel, such as windlasses, winches, steering-gear, and others, and the various parts of hull and deck which are subject to wear and tear. To these requirements must be added the incessant wants of the passenger departments, in the way of re-arrangement and extension of saloon or emigrant accommodation, the supplying and overhauling of the extensive fittings of the culinary and pantry branches, with the numberless minor but important requirements of a floating hotel.

To effectually fulfil these multifarious duties the Superintending Engineer has under his charge extensive repairing works, in which are located the various machines

and tools required to carry on the work of the different branches of manufacture and repair. Engineering, forging, smithing, brass and lead-founding, boiler-making, and general iron and steel work, plumbing, whitesmith's and tinsmith's work, brass-finishing, painting, carpentering and joinery, pattern-making, boat-building, sawing, leather working, laundry work, upholstering, electrical engineering, rigging, sail-making, electro-plating, and other kindred matters, are all placed under responsible foremen, who again, in most cases, have charge of a considerable staff to carry out the work on board when the vessels are in port. In the works are extensive stores, containing all the necessary articles constantly in requirement by the different departments, so that the vessels may be completely overhauled and outfitted by the line's own establishment and staff.

The other important department of the marine or "deck," as it is more commonly called, is under the control of the Marine Superintendent. This gentleman is responsible both for the general work of the ship in port, and for the efficiency of the navigating staff at sea; the latter consisting of the commander, officers, boatswains, quartermasters, and crew. The numerous other duties connected with the docking and berthing on arrival; the manner and rate of discharging and loading of cargo; coaling, and outfit for the coming voyage, also fall to his care. Acting with the Engineering and Victualling Superintendents, he generally, also, arranges for the work of the other departments which may require attention previous to commencing the next voyage.

The nature of this superintendence varies for almost every trip. At one time it is to extend or improve the saloon accommodation; at another, it is to arrange for dry docking, for the overhaul of machinery, or for surveying purposes. Sometimes the cargo holds may need attention; at others the meat chambers require alteration; on another voyage more extensive emigrant accommodation is needed; and at all times the equipment, either in sails (which, however, are now practically done away with), or running-gear, or lifeboats, or such-like subsidiary requisites, claims vigilant attention. Every now and then it is necessary to open-up, place in position, and expose all the various pump-gears, fire-hose, boat appliances, *et hoc genus omne*, for the annual inspection of the supervising authorities. Added to all these duties is, to a certain extent, the working of the freight at the quay side, for although this is controlled from the office by the freight department, it is necessary that the wharfingers and stevedores who manipulate it should work to suit the state of the ship.

Then comes the preparing for the voyage: seeing that the cargo and coaling is thoroughly completed; hatches and openings secured; decks washed down; and all made straight and fair, ready, with fit officers and crew, to receive the passengers and mails on the advertised date, and to pass the inspection, not only of the Government officials, but also the critical and exacting scrutiny of the partners or managers themselves.

The third division of the "Outside" section — the victualling department—is also under the charge of a responsible Superintendent, to whom is intrusted the

entire management of the stewards' department, the control of the outfit of the living-quarters both of the passengers and the leading sections of the crew, and the victualling throughout, including the supply of wines, medical requisites, and other articles necessary for the wants of so large a floating population. Besides the shore staff, the Superintendent is assisted on board by the purser, who generally takes charge of all the ship's papers and documents relating to finances, passengers, and freight; and who also, assisted by the chief and second stewards, supervises the working of the large staff required in the distribution of the saloon passengers in the berths and places assigned to them, in preparing for the daily meals, and in arrangements for cooking, baking, etc., so that the whole working may be such as to give satisfaction, insure cleanliness, and secure all necessary attention to each individual, whether in the state-rooms, saloon, or smoking-room. Another of the important functions of these officials is that of keeping a check upon the supply of the immense quantities of food and drink which are in almost continual demand. Not an unimportant object of attention for the Victualling Superintendent is the rearrangement of his staff, with due regard to the perpetual fluctuation in the number of passengers, as at one time the vessel may be full, and at another have but a few to provide for; so that, if too many hands are shipped, there is not work for them, and, on the other hand, if too few are shipped, the complaints of want of attention come in volumes from disappointed travellers.

To illustrate the elaborate system necessary for the

actual working of a twin-propelled Atlantic Liner, it is only necessary to describe the general routine of the various departments, beginning with the news of her coming arrival in the Mersey, which is generally received by telegraph from Queenstown, and again from Holyhead.

On the news being received in the general management division of the office, the expected hour of arrival is at once communicated to the Post Office and Custom House, and an hour appointed for the steam-tender to meet the liner, and, if she be passed, conduct her alongside the Landing-Stage. The passenger department, on being informed, generally communicates the hour of the tender's departure to the various hotels, railway companies, and others directly interested, and makes preparations for the landing of the passengers and the examination of their baggage by the Customs.

With this tender goes the Victualling Superintendent, accompanied by the Health and other Government officers whose duty it is to pass the ship for entrance into port, and grant permission for the disembarkment of the passengers.

On the arrival of the various papers and documents at the office, the ship is entered at the Custom House and all the necessary formalities are gone through to allow the work of debarkation to proceed, whilst the clerical department at once commences the work of sending out advices as to the supplies of coal, and the delivery of outward freight on quay for the next voyage.

The Marine Superintendent and his department, on learning the time of arrival, make all arrangements to dock and berth the ship as soon as possible after arrival, and get ready for the discharge of cargo, and the re-coaling. After the vessel is docked, the crew are paid off in the presence of a Board of Trade officer as soon as convenient, and now-a-days are at once signed on again for the next voyage. The chief officer then submits his "indent" for repairs, stores, and requirements for the next voyage, and this document guides the Marine Superintendent in his arrangements when the vessel is in dock.

As soon as the vessel is moored, work is commenced by the stevedores. The hatches are opened and the discharge of the cargo is busily proceeded with by a small army of men, some unloading and others coaling for the coming voyage. Immediately the holds are empty the re-loading is commenced, so that no time is wasted, and it is no uncommon thing to discharge 5000 tons of inward and load 4000 of outward cargo, and also put about 4000 tons of coal into one of these vessels in from two to three working days.

In the engineering department the work, although altogether out of the public sight, is much more extensive. As soon as the engines are stopped, the large staff is started to wipe down the machinery, blow down the boilers, or otherwise let off steam, and generally prepare the whole for inspection and overhauling.

The simpler portion of this is done at once; and when the chief engineer's "indent" has been through the hands f the Superintending Engineer, the important or heavy

work is proceeded with; both the sea-going and shore staff working conjointly, as the former are altogether responsible for the proper overhauling and adjustment of the moving parts, so as to insure good working at sea. The boilers after being cleared of the enormous quantity of ashes, soot, and rubbish, always consequent on such a large number of furnaces, are carefully cleaned out; if necessary the inside is scaled, and the whole is thoroughly overhauled by the ship's boiler-makers and the shore staff under an experienced foreman, and also under the keen supervision of the chief and second engineers, who are thoroughly alive to the fact that good work in port means less trouble at sea.

In addition to this work there is also the overhauling of the machinery in other parts of the vessel, and the sundry repairs required in the other departments, which only can be effected by skilled mechanics.

After the passenger department has finished with the disembarkation of the passengers, the chief steward turns his staff to clearing away and sorting the numerous *articles de voyage* which have been in use throughout the trip, some being put aside for next voyage, and others sent to the company's works for repair or overhaul. Of these, by far the most extensive is the "linen," as it is generally termed, and it may be here mentioned that so extensive and complete are the laundries that the whole of the table and bed-linen for over 400 saloon passengers can be returned to the ship in the space of forty-eight hours ready for use, thoroughly pressed and aired. As soon as the clearing up has been done and the Victualling Superin-

tendent has passed the "indent," the saloon, state-rooms, and other quarters, together with all furniture, are thoroughly overhauled and refurbished. The galley and pantry meanwhile are also being attended to by their respective staffs, aided here again by the shore staff, and the various cooking and serving utensils are replaced or sent to the works for repair. It is almost impossible for an outsider to realize the immense quantity of large and small articles which continually require repair or renewal in this department of large passenger vessels, and for the large liners an immense staff of tinsmiths is required to be continually at work, both in making new and patching up worn articles.

Another class of men kept continuously at extensive work are the carpenters and joiners, and also cabinet-makers, who, under an experienced foreman, are constantly engaged in the saloons, state-rooms, steerages, deck-houses, hatches, stores, and crew's quarters. The elaborate and extensive lavatories now-a-days required, also command the constant attention of experienced plumbers, owing to the labyrinth of pipe arrangements in the ship, which supply fresh and take away the waste water.

Draughtsmen are also constantly occupied in noting and making drawings of the changes and alterations continually being effected, both to keep pace with improvements and to further economize.

Besides all these hands directly engaged in work about the ship, it is necessary to retain, both at the quay side and the works, a large staff of book-keepers, clerks, and time-keepers to attend to the extensive wants of the

clerical department; and in addition, reliable watchmen to take charge during the hours when the workmen are off. One officer and engineer are also required to be on board, and certain others of the steamer's crew ready to act in case of fire or other casualty.

In addition to the overhauling for an ordinary stay in port, must be reckoned the very great extra work entailed if there be any heavy machinery to replace or any mishap on a voyage to repair, and also when the annual Board of Trade inspection required by law on all passenger vessels becomes due, as the vessel must then be put in dry dock. To this requirement must be largely attributed the excellent conditions and regulations now existing on all passenger vessels, although great credit also must be given to the enterprising owners, when urged by competition, for going even further than the requirements, in adopting all possible means to increase the safety and comfort of their passengers and crew.

In order to show the excellence of this annual inspection which is invariably carried out by the Board's own Officials (men of tried experience), it will not be out of place to briefly describe the routine and conditions necessary to obtain the renewal of the passenger certificate. The first thing is to pay into a mercantile marine office the necessary fees, which vary in amount according to tonnage, at the same time giving notice of where the vessel is lying, and also the hour she will be ready in a graving dock for the purpose of allowing the surveyor to "sight," otherwise carefully survey the bottom, propeller, and all other fittings not visible afloat, which must be

done before any painting or exterior work is effected. This is looked upon as the most vital point of the survey, the passenger certificate always dating from the day of sighting.

Other matters examined by the surveyors are the deck and other fittings and gear; the holds; and the hand and steam bilge-pumps, which must have all parts actually shipped in place, and the valves and interiors open for examination; in addition as many of the bilge strainer boxes as possible must be exposed, together with as many of the limbers,[1] in order to examine the state of the cement in bilges and to note any signs of working of the ship itself. The bulkhead sluices[2] must also be turned, the water-tight doors closed and opened, the handles and fittings for these being permanently attached or suspended in convenient position alongside. The fire-hose must be connected to the water service, and be stretched out for inspection with projecting nozzles attached, and connecting keys in place.

The elaborate equipment of boats has to receive careful attention; each must be uncovered and actually have on board the necessary sails, masts, yards, oars, thole-pins, and rowlocks, attached with strong chains; rudder and tiller ready in place, plugs, bailers, two fresh-water breakers or casks, bread-tank, life-belts, and axe, so that each article can be thoroughly inspected.

[1] "Limbers," the spaces between the frames of the vessel in the bottom under the ceiling.

[2] "Bulkhead sluices" are the valves in the bulkhead, etc., running through the bulkheads.

The capacities and lowering arrangements of the boats —which are strictly defined, not only by the British but also the United States authorities—must be up to standard, and a complete list of their sizes and capacities, when required, must be handed to the surveyor; the boats must also be lowered into the water to test the gear and their water-tightness.

All the scheduled signal and spare lamps must be cleaned and open for survey, the various fog-horns, rockets, etc., for night signalling, and the sounding leads, must be submitted to inspection.

The anchors must also be cleaned and scraped, with the official and proof numbers distinctly visible, and, in dry dock, the whole of the cables must be run out in the bottom of the dock and have the shackle-pins all backed out, so that the numbers may be verified with the certificates of tests.

A still more extensive survey has to be gone through in the machinery departments; the whole of the working-parts, such as cylinders, valves, pistons, pumps, crank-pins, bearings, safety-valves, fresh-water condensers and other portions must be opened up for inspection, also the boilers both in the steam and on the fire sides; it is also necessary at stated intervals to take off the propellers and draw in the stern shafts for examination. This precaution is now generally taken every twelve months by most of the leading lines, a practice strongly to be commended.

In addition to these requirements all the official papers of the ship, namely, ship's register, the various certificates relating to the compasses, chains, and anchors, and also

those of the captain, chief and second officers, and chief and second engineers, have to be presented for notification.

After all these steps have been completed, the Board's surveyor has to send to the principal office in Whitehall, London, a declaration made by him stating that the ship is complete in all requirements. On receipt of this the certificate is forwarded to the owners, which allows her to carry passengers for a stated period.

When it is remembered that, in addition to all these requirements, very extensive rules and regulations of the Board of Trade have to be complied with by the builders of the ship and machinery previous to the vessel's obtaining a certificate, it is evident that but little is left to be desired in the thoroughness of the protection afforded to the marine travelling public by the British Legislature; and when the enactments are carried out by the surveying staff with much ability, intelligence, and willingness to help at all times, as the author has experienced for over twenty years, there is no doubt they prove a strong incentive to all concerned to aim at and achieve a higher grade of perfection in the safe and perfect working of high-speed passenger vessels even than that now reached.

True it is that now and again murmurs of discontent arise from some enterprising builder or engineer, or from some far-seeing shipowner, who finds a restriction placed on some new untried advance; but if a successful trial proves a new idea to be satisfactory and safe so far as human life is concerned, which is the Board of Trade's first requirement, then ready acceptance may be obtained, even if outside the usual authorized forms.

In addition to this annual inspection in the home ports, another has to be undergone by the surveying staff of the United States Government, who, some nineteen years ago, enacted a law which rendered it compulsory for all vessels carrying passengers from the ports of that country to have a certificate, granted on somewhat similar conditions to the British regulations.

Returning now to the direct working of the ship: as soon as the advertised date for sailing draws near, the "Outside" section having had the work on board completed and all departments in order, steam raised and engines tried, and everything ready to receive passengers, while the "Inside" section has transacted all its portion of the work, definite dates are announced for the embarkation of first the steerage, then the second class, and finally the saloon passengers. This may take place at the loading berth in the company's dock, but more generally from the landing-stage, a notice of these hours being widely circulated. At a certain specified hour the official clearance takes place on board, which means the passing of the ship by the Health and Emigration officers, as well as by the Board of Trade, the Customs clearance having been arranged previously, so that the vessels may go out of dock into the river and await the passengers and mails.

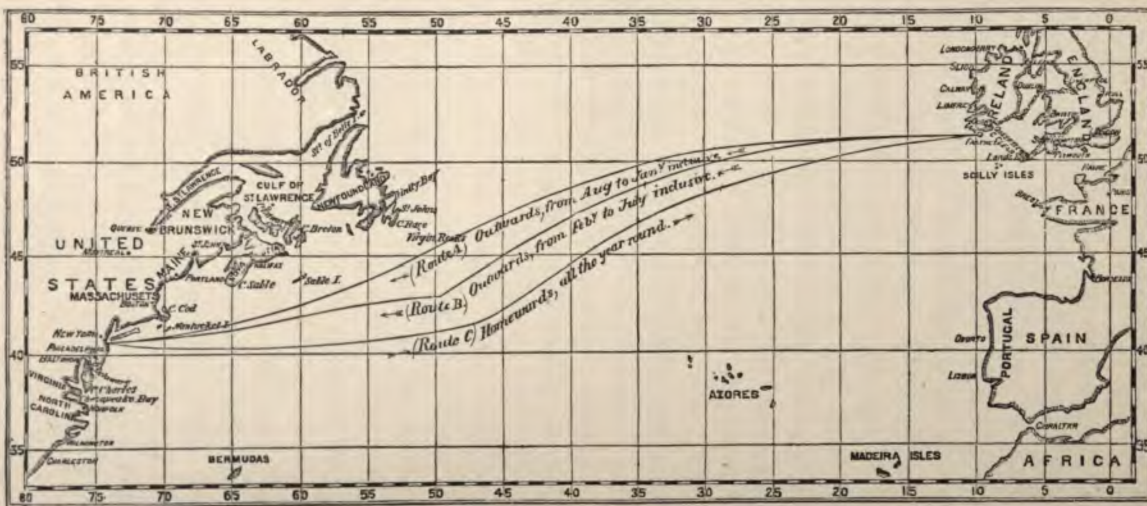
The form of clearing a vessel is carried out by two Government officers, one being a sea-going officer of tried experience from either the Royal Navy or Mercantile Marine, and the other a fully qualified medical man; these two gentlemen upon arrival proceed to examine the steerage passenger accommodation as to sleeping, lavatories,

exits, ventilation, and other necessaries; afterwards each individual steerage passenger, adult or child, has to pass the medical officer, to provide against the chance of any infectious disease on the passage. The medical outfit is subjected to examination, and the entire crew has to be mustered and pass the inspection of both officials, so as to insure their being fit and able men for their respective duties. A careful examination is also made of the life-boats, some being lowered into the water, and often an inspection of other details, such as night signals and rockets, the supply of fresh water, freeboard, etc. The necessary papers being filled in and signed, the vessel is cleared, and ready to proceed to sea as soon as the saloon passengers and perhaps mails are on board.

Up to the year 1895 the saloon passengers by the Liverpool Lines generally embarked by tender from the Landing-Stage, but in that year a great improvement was initiated, and the tenders done away with. This was brought about by allowing the liners themselves to come to the Landing-Stage, and as a new railway-station was built adjoining and connected to the London and North-Western Railway by means of the Waterloo tunnel from Edgehill, passengers were placed in direct communication to all parts of Great Britain. This tunnel had hitherto only been available for goods traffic.

This new service was inaugurated by the White Star **Germanic** coming alongside the stage on June 12th, 1895, and embarking the passengers direct from it; since that period all passenger liners have come alongside to embark and disembark their passengers.

ATLANTIC LINER TRACK CHART (MAURY'S LANES).



Distances—Route A, 2,783 knots. Route B, 2,855 knots. Route C, 2,889 knots.

[*To face page* 155.

When the time arrives for embarkation of the saloon passengers, the commander and officers are in attendance at the gangway to receive them, and all the stewards ranged ready, under the purser and chief steward, to direct them to their different rooms and berths, and attend to the removal of the smaller baggage; the larger baggage being stowed by the deck department in quarters especially set apart for it. After a short period, the whole of the passengers and their baggage being on board, and all ready for sailing, the vessel gets under weigh at once under the supreme charge of the captain, whose station is on the navigating bridge. With him is also the pilot to navigate the vessel through the channels and passages for which he is duly licensed. There is also on the bridge, alongside the captain and pilot, the fourth officer, whose duty is to transmit the engine-room and steering orders.

The chief officer's position when leaving or entering port is in the bow of the ship, to attend to the working of the anchor, and other duties in that quarter; to attend to the stern, the second officer takes up his position on the poop; the third officer gives special attention to the prompt carrying out of the orders given to the quartermaster at the wheel, and so on, each officer having a proper station and duty assigned to him.

In the engine department, also, the duties of each of the staff are distinctly defined for the time of leaving and entering port; so that nothing is left undone to secure systematic working throughout.

After the vessel has got fairly under weigh and cleared the channel, the "stand-by," as it is technically termed, is

dispensed with, and the duties are changed for the regular watches at sea, not to be changed again until the arrival off New York, except in event of foggy weather coming on at sea.

The celebrated Landing-Stage, which plays so useful a part in the coming and going of the Liverpool Liners, is one of the most important appurtenances of the great port on the Mersey. Notwithstanding its close proximity to the surface of the water, it was completely destroyed by a fire on July 28th, 1874, which broke out at a spot alongside where the author was standing at the time, and the fumes from which drove him in a few minutes for shelter on board one of the Birkenhead ferry-boats, which also had to move away almost immediately. This disaster was occasioned by some workmen who were working near the embayment (then and for some years afterwards existing) in the stage, allowing a naked light to set fire to some of the creosoted wooden beams below the deck of the stage, and owing to the inflammable nature of the material and to its inaccessibility, no effectual means could be found to extinguish it, so that the whole structure, extending nearly half a mile, was totally destroyed. Some idea of the extent of the fire can be gathered from the illustration, which is reproduced from a photograph taken from the Birkenhead side about three hours after the fire commenced. No lives were lost, but the reconstruction of the stage occupied a considerable period, and entailed a cost of £250,000.

THE BURNING OF THE LIVERPOOL LANDING-STAGE, JULY 28, 1874.

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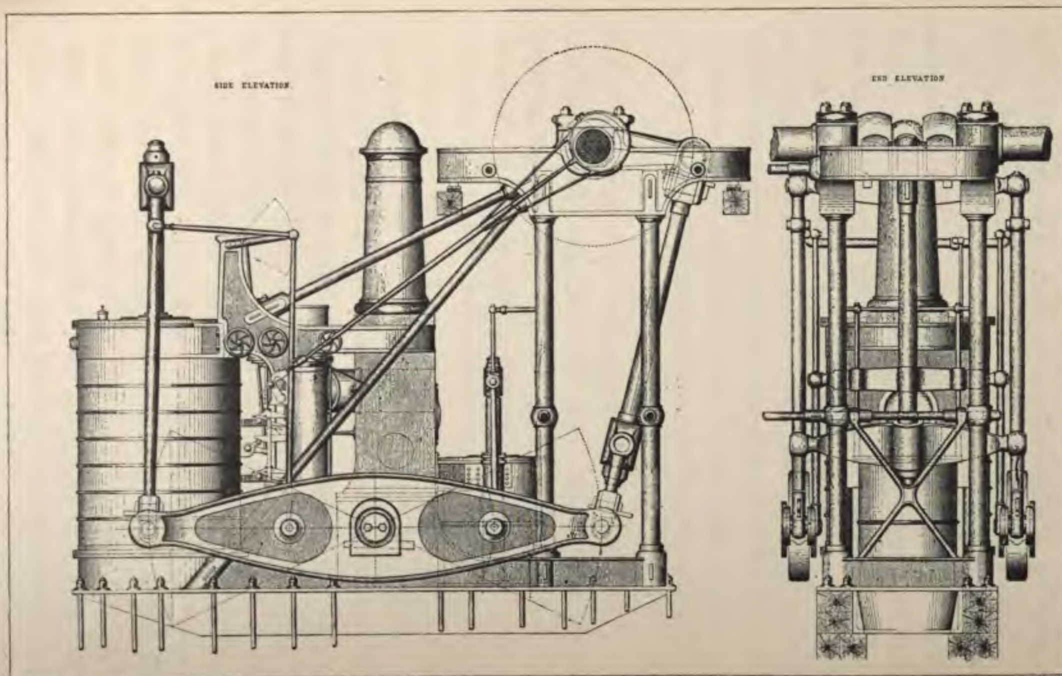
The displacement of the earlier vessels being almost impossible to obtain, the author has, for the sake of comparison, calculated the whole of the vessels after a similar manner, so that they may be as nearly as possible on the same basis. According to these figures, the actual or indicated horse-power on this vessel was about ·0048 indicated horse-power to one ton of displacement (1850 tons). The speed is recorded as six knots per hour, so that in 1819 the first Atlantic steam-vessel represented 1850 displacement tons, propelled at the rate of six knots through the water for an expenditure of fuel of 7½ cwt. of coal per hour. One peculiarity of the **Savannah** which must be noted, was, that she had no paddle-boxes, and was the only vessel fitted with joints or couplings on the paddle-shafts, to allow the paddles being lifted in on deck.

The next steamers, the **Royal William**, **Sirius**, **Liverpool**, **British Queen**, and **Great Western**, had a form of machinery which became at that time almost universal, namely, the side-lever type to work the paddle-wheels (see illustration of **Arctic's** engines, p. 160); each had two cylinders, or, in fact, two separate engines, the **Sirius** and **British Queen** being singular in the fact of having surface-condensers after the design now existing. The boilers of all these vessels were of the flue type, carrying very low pressures, such as 5 lbs. per square inch in the first-mentioned and 10 lbs. and 12 lbs. in the others. The actual or indicated horse-power ranged from 400 to 700, and piston-speed 170 feet per minute on a consumption of 6 to 7 lbs. per indicated horse-power, and a ship speed of from seven to eight and a half knots, with a daily

consumption of from 17 to 33 tons. Calculated on the same basis as for the **Savannah**, the indicated horse-power to one ton of displacement was ·03.

In 1838 the Atlantic Liners represented 1980 displacement tons, propelled eight knots for an expenditure of fuel of about 23·2 cwt. of coal per hour. The weight of the machinery of these vessels ranged about 1500 lbs. per indicated horse-power (470 tons), including water in boilers. The fuel on board leaving Liverpool was about 600 tons, so that out of the 2300 tons, which was their displacement, 46 per cent. of it was absorbed by the propelling machinery and fuel.

In 1840, the year which saw the commencement of the Cunard Line, their first steamer, the **Britannia**, was fitted with the same type of engines and boilers as were constructed in 1838, the only difference being the total abandonment of the surface condenser. The boiler-pressure was 12 lbs per square inch, the diameter of cylinders 72½ inches, with 6 feet 10 inches stroke, and the indicated horse-power ranged about 740, with a piston-speed of 190 feet per minute, and a consumption of 4·7 pounds per indicated horse-power. The speed of vessel was eight and a half to nine knots on a consumption of about 31 cwt. of coal per hour, and the indicated horse-power to one displacement ton was ·036. The weight of machinery ranged about 1400 lbs. per indicated horse-power (460 tons) with water, which, with the fuel when leaving port (600 tons), reached 51 per cent. of the 2050 tons displacement. This vessel and sister ships were fairly typical of the period 1840 to 1848, when slightly larger



ENGINES OF THE U.S. MAIL STEAMER ARCTIC, 1849.

and faster vessels, the **America, Niagara, Europa**, and **Canada**, were added, which represented 3100 displacement tons, propelled ten knots for 36·7 cwt. of coal per hour.

The pressure carried in the earlier days was so slight, that in the log-book of the **Britannia** it was recorded on one occasion: "Broke the larboard steam-pipe, lapped it with canvas and rope-yarn and proceeded with low pressure," meaning evidently 4 lbs. or 5 lbs. per square inch. So much has been noted of this old vessel, that it is interesting to here give the names of the first engineers who served on board. The chief was named Mr. Peter Kenneth; the second, Mr. Thomas Brown; the third, Mr. James Bell; the fourth, Mr. Robert Waddell, who afterwards rose to be chief engineer of the **Scotia**; and Mr. James Wardrop, fifth.

In 1849 the Collins Line commenced with the paddle-steamers **Atlantic** and **Arctic**, which also had side-lever jet-condensing engines, with cylinders 96 inches diameter, 10 feet stroke; the steam-pressure was 17 lbs. per square inch, generated in four rectangular boilers of new design, in some of which were fitted a double row of furnaces, one above the other. The indicated horse-power was 2000 with piston-speed of 320 feet, and 4 lbs. of coal per indicated horse-power, the speed of ship being twelve and a half knots on a consumption of 71 cwt. per hour, and the indicated horse-power to displacement ton was ·3. The weight of the machinery was 800 lbs. per indicated horse-power (714 tons), which, with fuel leaving port (1200 tons), reached 30 per cent. of the 6500 tons displacement.

Ericsson Ship.

Following this vessel, early in 1853, came a craft in which one of the boldest attempts to find a substitute for steam was ever made; this was the **Ericsson** (see p. 51 *ante*), or the Caloric ship, as she was commonly called. The machinery was of such a peculiar design that it is worth giving a full description of it as published about the time she was being tried.

The leading peculiarity of the Caloric ship is in the application of heated air to the propulsion of the vessel.

The engine consisted of two pairs of cylinders connected in their action, but not placed side by side. Each pair was composed of two cylinders, of which the lower one was the larger. The upper, termed the supply cylinders, were each 137 inches diameter; the lower, the working cylinders, were each 168 inches diameter, and these were placed exactly amidships. The working of the machinery was effected by a fire in the furnace which was connected to the lower cylinders, but about 5 feet away from them.

The air thus heated was led into the upper or supply cylinders by a series of valves arranged for the purpose, and then acted on the piston; the pistons of both cylinders worked simultaneously; the vacuum created by the escape of air from the lower or working cylinder caused the descent of the lower piston, which drew down with it the piston of the supply cylinder, and the work of the engine was thus commenced. A series of valves each 2 feet in diameter

were placed in the tops of each supply cylinder, and these valves instantly opened at the end of the stroke; a current of cold air then rushed in and pushed up the piston of the upper cylinder, until it was stopped by the Regenerator, a contrivance invented by Captain Ericsson. He found by experiment that the absorption and radiation of heat from metallic surfaces were nearly instantaneous, and that the expansive force of air, when its volume is doubled by the application of heat, was almost equal to the power of steam; the application of this principle was the great feature of the Caloric ship.

The Regenerator consisted of a series of fine wire-nettings of iron, placed side by side to the thickness of 12 to 20 inches. As the air passed through this maze of metallic surfaces, it penetrated through the minute cells formed in the interstices of the wires, and took up the great volume of caloric, which increased its temperature. The maximum of heat absorbed by the air in this passage through the Regenerator was 450°, the minimum necessary to be applied from below was 30°, making an aggregate of 480°, at which point the volume of air entering the engine was exactly doubled, and by the expansive force set in motion the crank-shaft, so producing the revolution of the paddle-wheels. A very small percentage of the volume of the atmospheric air employed was permitted to go to waste, so that the Caloric principle involved no useless expenditure of material. The supply of fuel required to continue the operation of the engine was but a few pounds of anthracite coal, and there were no boilers or large furnaces; as a security against accidents

the entire floor of the engine-room was laid with cast-iron flooring.

The construction of the furnaces, and the small amount of fuel required to feed them, caused a great saving in stowage-room of the Caloric ship, by which it gained largely in accommodation for merchandise and freight.

Following the **Atlantic** came the **Persia**, in 1856, and the **Scotia** in 1862, both with side-lever, jet-condensing paddle engines, which were the last of the type. The various parts of the machinery were very massive owing to the fairly large indicated power, the cylinders being $100\frac{1}{2}$ inches diameter and 12 feet stroke. The eight boilers were of the usual low-pressure, multi-tubular type, with forty furnaces, carrying in the **Persia** 20 lbs., and in the **Scotia** 25 lbs., and fitted with horizontal tubes. The indicated horse-power was 3600 and 4000 respectively, working at a piston-speed of 360 feet per minute with a consumption of 3·07 lbs. per indicated horse-power, and speed of thirteen and a half knots, with a consumption of 130 and 160 tons per twenty-four hours; the indicated horse-power to displacement ton was ·46. From this data it may be seen that in 1860 the Atlantic Liners represented 8700 displacement tons, propelled thirteen and a half knots for about 100 cwts. of coal per hour. The weight of the machinery was about 1000 lbs. per indicated horse-power (1800 tons in all), which, with the fuel on board (1800 tons) at sailing, reached 3600 tons, equal to 40 per cent. of the displacement.

As the Collins Liner **Adriatic** followed the Cunard **Persia**, in 1858, it was but natural that the machinery should

be of the most efficient kind to ensure the vessel being faster than her rival, or than any other craft then afloat, and as the Americans adopted a new departure, it will not be out of place to here describe it at length.

These were made by the Novelty Ironworks of New York, with two oscillating cylinders 104 inches diameter by 12 feet stroke, working diagonally up to the crank-shaft, one on the forward side, and one on the after side of it.

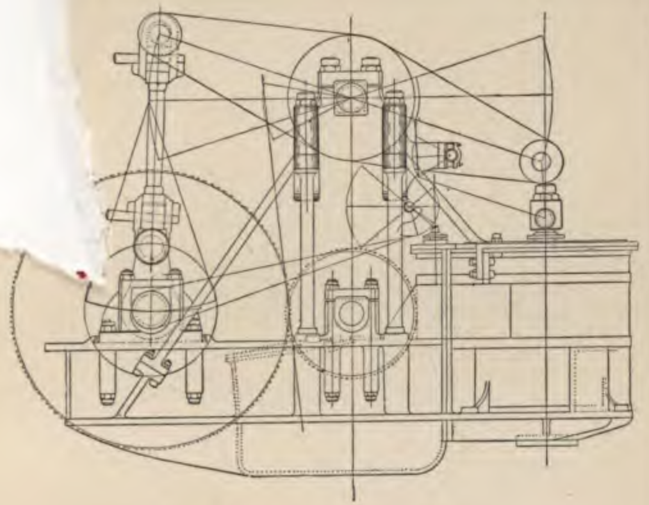
To do away with the intermediate shaft, a drag-link was fitted between the cranks, and a complicated arrangement of levers and links were fitted to work the slide-valves and pumps; there was also the then novelty of a surface-condenser, so that the machinery altogether represented a different practice from that prevailing in Great Britain. The paddle-wheels were of the non-feathering type, 40 feet diameter, with floats 12 feet long by 2 feet wide, and working about 17 revolutions per minute, which indicated 4000 horse-power, and gave a speed of about thirteen and a half knots. Steam was generated at 25 lbs. pressure in eight box-boilers, having tubes placed vertically; the number of furnaces was forty, and the daily consumption of coal was about 160 tons. The indicated horse-power to displacement ton was ·53, so that the finest wooden Atlantic side-wheel liner represented 7500 displacement tons, propelled thirteen and a half knots for about 125 cwt. per hour; and as the machinery was 1100 lbs. per indicated horse-power (1900 tons), this, together with the fuel on board (1700 tons), reached 49 per cent. of the displacement.

Following the **Persia** came the **Great Eastern**, in 1858, which was fitted both with paddle-wheels 58 feet diameter and a single screw-propeller 24 feet diameter. The paddle engines of 5000 indicated horse-power were constructed by Scott Russell and Co. at Millwall, and had four oscillating cylinders working on two cranks each 74 inches diameter and 14 feet stroke, which worked diagonally up to the crank-shaft, two leaning from forward and two from aft. For these (paddle) engines there were four box double boilers with horizontal tubes, having forty furnaces in them, carrying 30 lbs. steam-pressure.

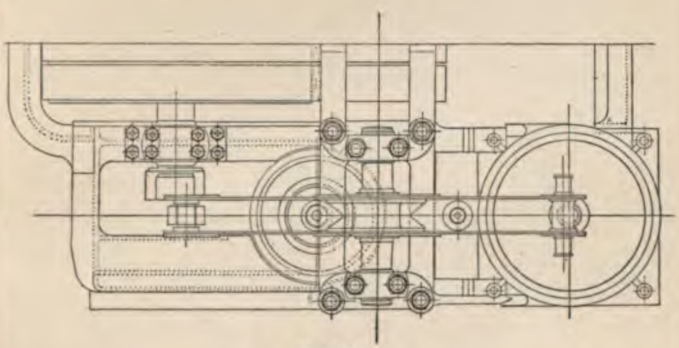
The screw-propelling engines of 6000 indicated horse-power had four oscillating cylinders, each 84 inches diameter and 4 feet stroke, which worked horizontally on the two cranks, and were placed opposite to each other, and were made by James Watt and Co., Soho, near Birmingham. Steam was supplied by six similar but larger boilers to the paddle engines, having seventy-two furnaces with a steam-pressure of 25 lbs. In this great ship the total indicated horse-power to displacement ton was ·034, and she represented 32,160 displacement tons, propelled thirteen knots for nearly 300 cwt. per hour.

The design of the side-lever engine, being fairly suitable for the paddle-wheels, was generally retained down to the **Scotia**, the last of the side-lever type, and it was still such a favourite as to induce modifications of its being retained for screw-propulsion in the form of a beam engine.

The first screw-vessel on the Atlantic to be fitted with this type was the Inman **City of Glasgow**, in 1850. The engines were fitted with two beams working across the ship,



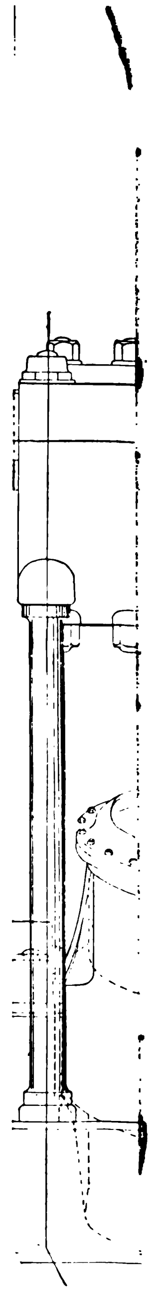
End Elevation, Looking Aft.



Half Plan.

ENGINES OF THE ETNA, 1855.

[To face page 166.



the cylinders being placed on the one side of the ship, and on the other the large wheel which geared three to one with ordinary teeth into the pinion on the propeller-shaft; the diameter of the cylinders was 71 inches, and stroke 5 feet; ordinary jet-condensing was used, and three flue-boilers, carrying 10 lbs. pressure. The indicated horse-power was about 800, with a piston-speed of 200 feet per minute, and a consumption of 6 lbs. per indicated horse-power. The speed of vessel averaged nine knots on a consumption of 42·8 cwt. per hour, the indicated horse-power to one displacement ton being ·27. The weight of the machinery averaged about 1200 lbs. per indicated horse-power (428 tons), which, with 800 tons fuel leaving port, reached over 42 per cent. of the displacement (2910 tons). The propeller had two blades, and was 13 feet diameter and 18 feet pitch.

The next screw-steamer was the **City of Manchester** for the same line. This vessel's engines, although having the same size of cylinders and stroke and same proportion of gearing, were entirely different from the **City of Glasgow**, being what were termed steeple-geared engines—that is, with the crank-shaft placed in a line vertically over the screw-shaft. With various modifications the geared engines for driving the propeller-shaft were generally used, up to about the year 1858 the different styles fitted being the beam, steeple, vertical, and the oscillating cylinder, which was used for the last time on the Cunard **China** and **Cuba**, in 1862 and 1865 (see illustration of **China's** engines, facing p. 167).

This system of gearing for screw engines of what were

then considered large power, was introduced to keep down the high piston-speed which would have been required if the engines had had their piston-rods and crank-shaft connected direct to the screw-shaft, the revolutions for a side-wheeler ranging from 14 to 18 per minute, whilst those for the screw-shaft required to run from 40 to 80, 90, and sometimes even 150, which was then considered much too fast for ordinary wear and tear.

An interesting anecdote, which illustrates the marked difference between the relative velocities of the paddle-wheel machinery and the direct-acting inverted screw engines, is often told of one of the older chief engineers, who had been transferred from the charge of one of the slow-moving paddles to a quick, direct-acting screw. He was struck by the apparent working full speed of the engines, although the order from the bridge had been given to go slow ahead; after surveying the situation for a moment he called out to the second engineer, who was handling the engines, "The order is to go *slow*, better slow her down at once." To this the second replied, "They are going dead slow;" on which the chief at once answered, "Is that so? Well, they may get some one else to take the charge of this job, for I won't be in the engine-room when they are going full speed, as it would not be safe, they are sure to fly to pieces."

In the year 1854 the now almost universally adopted inverted direct-acting screw engines were first introduced upon the Atlantic on the first Allan Line steamer **Canadian**, and were then generally termed "tilt hammers." The engines were almost identical with the type

existing to-day, and had two cylinders, each 62 inches diameter and $3\frac{1}{2}$ feet stroke. The weight of machinery was 650 pounds per indicated horse-power, and the indicated power 1100, with piston-speed of 290 feet per minute on a consumption of 4·5 pounds of coal per indicated horse-power, the speed of vessel being ten knots per hour, the indicated horse-power being ·36 to the displacement ton, on a consumption of 35·6 cwt. per hour.

After this period the direct-acting engine gradually came to be adopted, and was made in many designs, such as the horizontal trunk, and return connecting-rod form, the annular having the piston working upwards on a cross-head with two piston-rods and long connecting-rod from that passing through an open trunk in the centre of the cylinder down to the crank-shaft underneath it. Other forms were the diagonal cylinder, the horizontal direct connecting-rod, the inverted and horizontal combined, and, lastly, the inverted direct-acting now in use. The system adopted by the Inman Line in their first **City of New York**, built in 1861, was the horizontal trunk with two cylinders, each 69 inches diameter and 3 feet stroke, and fitted with surface-condensers, which began to be again adopted about 1860. The indicated horse-power was about 1500 and piston-speed 300 feet per minute on consumption of 4 lbs. per indicated horse-power, the weight being 650 lbs.; the speed of vessel was eleven and three-quarter knots, consuming 47 cwt. per hour, the indicated horse-power to the displacement ton being ·33.

The horizontal form of direct-screw trunk engine was adopted in many other steamers, and both in that form

and the return connecting-rod type was retained down to 1871, when the Inman vessel, the **City of Montreal**, came out with double trunk cylinders of 85½ inches, and 4½ feet stroke, and 50 lbs. pressure generated in oval boilers. Up to this date this steam-pressure was the highest used on the single-expansion principle, with a consumption of about 4 lbs. per indicated horse-power.

Owing to the superiority of the compound engine being then recognized, these engines were altered in 1876 to the double-expansion form, and this was effected by merely removing the original cylinders and placing two new of altered diameters, namely, 75½ inches for the high-pressure and 111½ inches for the low-pressure, both having trunks 46 inches diameter as in the original cylinders. No alterations were made in the boilers nor steam-pressure, and the consumption by so compounding was reduced from 4 to 3 lbs. per indicated horse-power. This alteration is, so far as the author can trace, the only one in this trade where the original engines were compounded without altering the boiler-pressure or doing away with the trunks in the cylinders.

Another form of direct-acting engine tried by the Inman Line was an inverted diagonal four-cylinder arrangement, patented by their consulting engineer, and fitted on the s.s. **City of London,** built in 1863. These were replaced by trunk engines a few years afterwards when the vessel was lengthened. With the view of shortening up the space required for the engines, and so allowing more cargo capacity, a combination of the horizontal trunk and inverted direct-acting engine was adopted in a number of vessels,

as by this means only one crank-shaft was required; this was also used for the compound system on the Guion Liners **Wyoming** and **Wisconsin**, built in 1870, the high-pressure cylinders 60 inches working inverted, and the low-pressure 120 inches horizontally at right angles to it, with 3½ feet stroke.

The most remarkable engines constructed after this arrangement were the Guion Liners **Montana** and **Dakota**, in 1872 (shown on pp. 174, 175), which had compound-engines designed to work at the then considered enormous pressure of 100 pounds. There were three cylinders—one high-pressure, 60 inches diameter, working inverted over the forward crank, with a surface condensed and pumps placed on each side of the shaft, and two low-pressure, each 113 inches diameter, placed horizontally and working on the after crank on the return connecting-rod principle, the crank being set at 180° from the forward crank; the stroke was 3½ feet. Another peculiarity was that the valves of all the cylinders were of the Corliss type (marked A), as had been tried on the earlier vessels **Nevada, Wyoming**, etc.

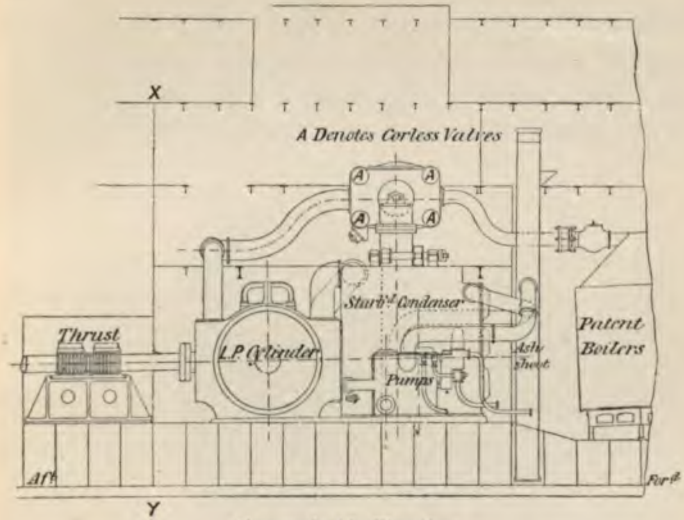
Another peculiarity shown on this diagram is the vertical ash-shoot, into which the overboard discharge of the circulating water is led. The idea of this shoot, which was first introduced on the earlier White Star boats, was to avoid the annoyance caused in passenger vessels by the putting of the ashes overboard, but it was only a partial success, giving rise, like many other contrivances, to greater evils than it cured, so that it was eventually done away with on all vessels.

Another feature of the two sister vessels, the **Montana**

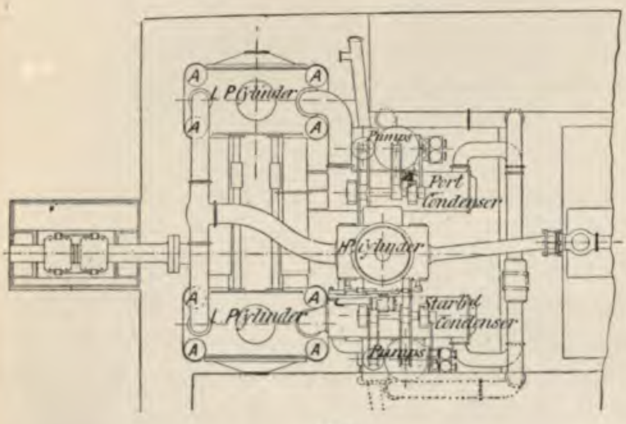
and **Dakota**, is clearly shown on the section, namely, the excessive "tumble home" [1] of the vessels about midships, which gave them a very peculiar appearance.

In the **Montana** and **Dakota**, to carry the high pressure of 100 pounds a special design of water-tube boilers was adopted, the tubes being placed horizontally over the fires, about 15 inches diameter, but, like the other system of water-tube boilers, they were a failure, and had to be replaced with the ordinary cylindrical boiler carrying 80 lbs., which no doubt affected the speed of the ships, as they never came up to that which was expected from them. After the year 1869, the compound engine (which Mr. John Elder had proved to be a commercial success on the Pacific Company's screw-steamer **Brandon** in 1854, with 42 lbs. boiler-pressure, and paddle-vessels **Inca** and **Valparaiso** in 1856) began to be most universally adopted. All other designs of marine engines for screw propulsion in both the Royal Navy and Merchant Service were gradually abandoned in favour of the inverted direct-acting form, the individual whimsicalities being expended in devising numerous ways of arranging the systems for double expansion by the placing of the cylinders one in one fashion, and another in another. The first vessel with compound-engines to be engaged in the Transatlantic trade was the s.s. **Holland** of the National Line, which was fitted with new boilers when being lengthened by Jack,

[1] This term "tumble home" is used by nautical men to denote the manner in which the sides of the vessels gradually recede inwards from a little below the water-line to the deck level; this was done to a great extent in the old three-decker line-of-battle ship.



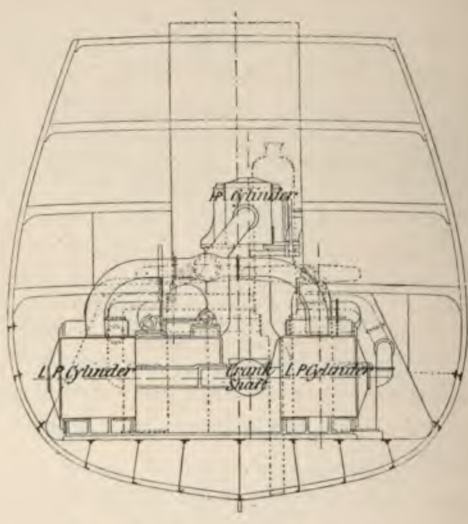
Fore and Aft Elevation.



Plan.

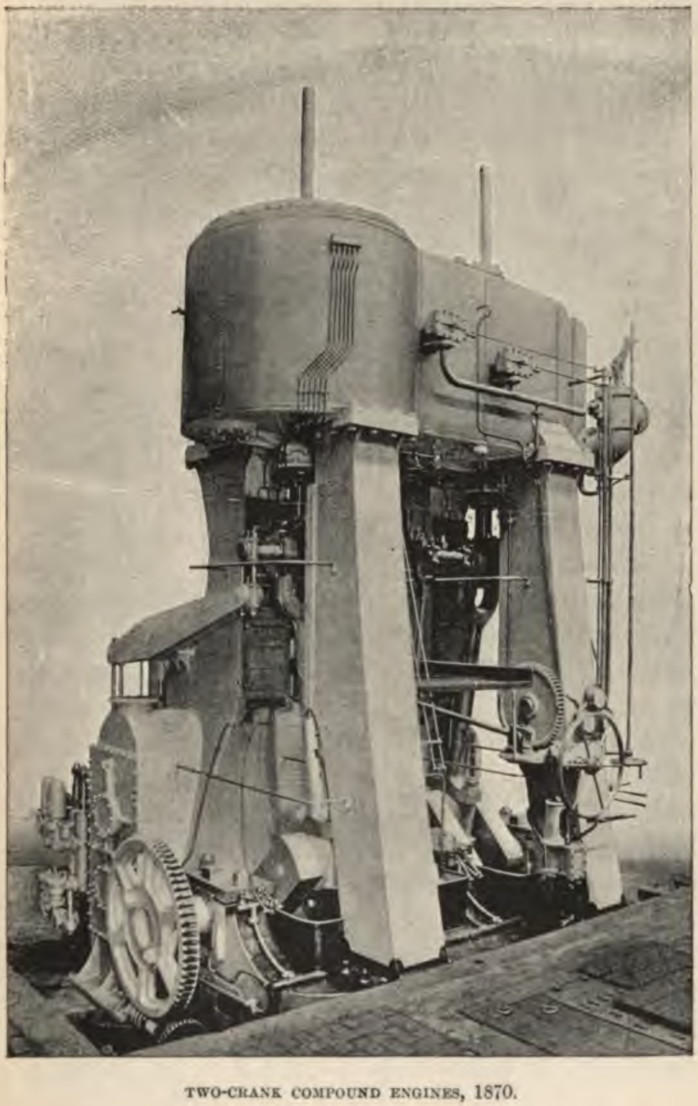
THREE-CYLINDER COMPOUND ENGINES, MONTANA AND DAKOTA, 1872.

Rollo and Co., of Liverpool, in March 1870, and had the original engines replaced with new two-cylinder receiver type, the diameter of high-pressure being 46 inches, and of low-pressure 86 inches, with 4 feet stroke. The pressure



Sections at X Y looking forward.
THREE-CYLINDER COMPOUND ENGINES, MONTANA AND DAKOTA.

carried was 60 lbs. per square inch, which at that period was considered very high. Immediately following the **Holland**, in the same year, came another of the receiver, two-cylinders, two-crank compound type on the **Italy**, also for the National Line, which was built by John Elder and Co. The cylinders were 60 and 90 inches diameter, and stroke 4 feet, with a boiler-pressure of 65 lbs. This form



TWO-CRANK COMPOUND ENGINES, 1870.

of engine, as is well known, became the standard, and was almost universally adopted.

Following on from 1870, nothing but compound engines with two cranks were fitted, and it would be almost impossible to enumerate the different arrangements of high and low-pressure cylinders which were fitted; but just before the advent of the triple engine it may be said only two types survived, namely, the receiver two-cylinder and tandem, having the high-pressure cylinder on top; the largest of this type being fitted on the **City of Rome**, with three cranks and three sets of cylinders, in 1881, indicating up to 11,500 horse-power. Coming after these was the type having one high and two low-pressure cylinders, which became feasible when the three-throw crank-shafts were introduced to the Atlantic trade for the first time on the **Arizona** in 1879.

In 1871 the high-speed vessels on the Atlantic with compound engines were represented by the two-cylinder receiver engines on the National Liner **Egypt**, with cylinders 60 and 100 inches and stroke of 4 feet 6 inches, the boiler-pressure being 60 lbs.; and the White Star Liner **Baltic**, with four-cylinder tandem compound engines 41 and 78 inches diameter and 5 feet stroke, boiler-pressure 65 lbs. Both vessels had two cranks in each case. In the first-mentioned ship the average piston-speed was about 520 feet per minute, the indicated horse-power ranging about 3000 on a consumption of 2·1 pounds per indicated horse-power. The speed of ship averaged twelve knots on a consumption of 56 cwt. per hour, and indicated horse-power to displacement ton was ·37. The weight of

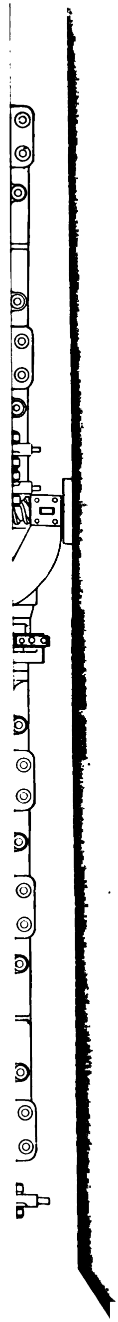
machinery with water was about 500 pounds per indicated horse-power (670 tons), which, with the 1000 tons of fuel leaving port, reached 20 per cent. of the displacement (7980 tons). In the case of the **Baltic** these particulars were:—Piston-speed of 530 feet per minute, indicated horse-power 3000, consumption 2·1 pounds per indicated horse-power, speed of vessel over fourteen knots, the indicated horse-power to displacement ton being ·4, machinery weight 490 pounds per indicated horse-power (660 tons), which, with the fuel leaving port (900 tons), reached 22 per cent. of the displacement (7100 tons).

The satisfactory working of the four-cylinder tandem engines on these boats caused this design to be largely adopted for full-power steamers, but owing to the introduction of the three-cylinder engines, and the triple-expansion, those fitted on the **Britannic** and **Germanic** in 1874 and 1875 were the last in new vessels, although the **City of Brussels** had her original horizontal trunk engines replaced by the four-cylinder type in 1876, and others at even later date.

Beyond a gradual increase in the boiler-pressure of from 60 lbs. to 90, there was but little change until 1879, when the **Arizona**, with the three-crank double-compound engine, commenced running. In this vessel the high-pressure cylinder, 62 inches diameter, was placed over the middle crank, and low-pressure cylinders, 90 inches diameter, over the forward and after cranks, the stroke being 5½ feet and boiler-pressure 90 lbs., working up to 6300 indicated horse-power. A slight increase was

made on the prevailing piston-speed, which was increased to over 600 feet per minute.

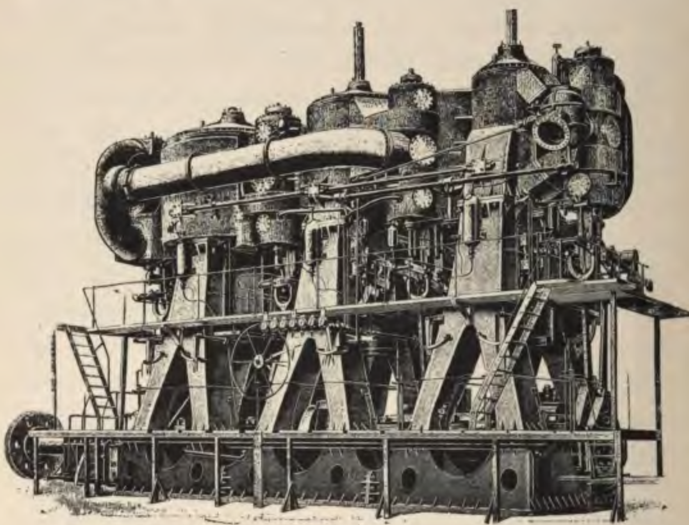
After the **Arizona**, in 1879, several large vessels with powerful machinery came out, all fitted with three-crank double-compound engines and cylinders similarly placed, but each with a slight increase of boiler-pressure and piston-speed. One of the largest of these was the **Servia**, which had one high-pressure cylinder, 72 inches diameter, and two low-pressure, each 100 inches, with a stroke of 6 feet. The indicated horse-power reached 12,000, with a piston-speed of 680 feet per minute, and consumption of 2 lbs. per indicated horse-power. The speed of ship averaged nearly seventeen knots on a consumption of 168 cwt. per hour, and the weight of machinery was 490 lbs. per indicated horse-power (2625 tons), which, with the fuel (2000 tons) leaving port, reached 37 per cent. of the displacement (12,300 tons). One of the most remarkable steamers on the three-crank compound principle was the **America**, built for the National Line in 1883, which had three cylinders, one high-pressure of 63 inches and two low-pressure of 91, and stroke of 5½ feet, and 95 lbs. boiler-pressure. These engines indicated up to 8300 indicated horse-power at a piston-speed of 689 feet per minute on a consumption of about 2 pounds per indicated horse-power. The speed of ship averaged eighteen and three-quarter knots on 148 cwt. of fuel per hour. The weight of machinery was about 490 lbs. per indicated horse-power (1815 tons), which, with 2000 tons of fuel on board leaving port, reached 40 per cent. of the displacement (9550 tons).



In a few vessels the high-pressure cylinder was placed over the forward crank, and in others over the after crank. The last of the large powerful steamers of this three-cylinder three-crank type were the **Umbria** and **Etruria**, in 1884 and 1885, which had each one high-pressure cylinder of 71 inches and two low-pressure of 105 inches diameter, and 6 feet stroke, working at 110 lbs. pressure to over 14,000 indicated horse-power at a piston-speed of 800 feet per minute on a consumption of about 2 pounds per indicated horse-power. The speed averaged nineteen and a quarter knots on 250 cwt. of fuel per hour, and weight of machinery ranged about 490 lbs. per indicated horse-power (3100 tons), which, with the fuel on board (2500 tons), reached 42 per cent. of the displacement (13,300 tons), the indicated horse-power to displacement ton being 1·06. Owing to the successful work of the three-crank triple-expansion system as demonstrated by the Australian Liner **Aberdeen**, in 1881, no large double-compound engines have since been put in the Atlantic trade, and the first regular vessel to have the triple-expansion engine in that service was the Wilson Liner **Martello** in 1884 (see illustration adjoining), followed in 1885 by the North German Liner **Aller**, built and engined on the Clyde.

In 1888 the three-crank triple-expansion engines were introduced on the **New York** and **Paris** (the late **City of New York** and **City of Paris**). In each boat were fitted two sets (port and starboard) with the high-pressure cylinder over the forward crank, the intermediate over the centre crank, and the low-pressure over the after crank.

The diameters of the cylinders are, respectively, 45, 71, and 113 inches, and stroke of 5 feet, with 150 lbs. boiler-pressure, the indicated horse-power being 18,500, and piston-speed 860 feet per minute, and consumption of 1·6 lbs. per indicated horse-power, the speed being



THREE-CRANK TRIPLE ENGINES, 1888.

20 knots, with a consumption of 264·3 cwt. of coal per hour. The weight of machinery ranges about 480 lbs. per indicated horse-power (3955 tons), which, with fuel leaving port (2800 tons), absorbs 39 per cent. of the displacement (17,270 tons), the indicated horse-power to displacement ton being 1·07.

Following soon after the two Inman boats came the

two White Star Liners **Teutonic** and **Majestic**, in 1889 and 1890, also twin-screws with two sets of three-crank three-cylinder triple engines of nearly similar design to the two **Cities**, the cylinder diameters being, respectively, 43, 68, and 110 inches, and stroke 5 feet, with 180 lbs. pressure, indicating about 17,000 horse-power on a piston-speed of 820 feet per minute, the consumption being 1·55 lbs. per indicated horse-power, and speed of 20 knots on a consumption of 235·3 cwt. per hour. The weight of machinery, owing to the extensive substitution of steel and brass for cast-iron, ranges about 470 lbs. per indicated horse-power (3567 tons), which, with fuel on board leaving port (2800 tons), absorbs nearly 38 per cent. of the displacement (16,800 tons), the indicated horse-power to the displacement ton being about 1.

In 1893 the Cunard **Campania** and **Lucania** came out with three-crank triple engines, with five cylinders for each set—that is, with a high and low-pressure placed tandem fashion (as in the early four-cylinder double-compound engine) on the forward and after crank-shaft, and the intermediate cylinder on the middle crank-shaft. This form of engine was first introduced on the Atlantic Ferry by the same builders on the North German S.S. **Lahn** in 1888.

The diameters of the cylinders for each set of engines are, two high-pressure each 37 inches diameter, one intermediate cylinder, 79 inches diameter, and two low-pressure each 98 inches diameter, with a stroke of 5 feet 9 inches. The boiler-pressure is 165 lbs., and the total indicated horse-power has reached 30,000, with a piston-speed of

950 feet per minute, and coal consumption of 1·5 lbs., and speed of 22 knots on a consumption of 401·7 cwt. per hour. The weight of machinery is 480 lbs. per indicated horse-power (6400 tons), which, with the fuel on board leaving port (3000 tons), absorbs about 47 per cent. of the 21,000 tons displacement, the indicated horse-power to displacement ton being 1·5.

In 1894 the American Line **St. Louis** and **St. Paul**, built in Philadelphia, came out with four-crank six-cylinder quadruple engines as described on p. 115, and a boiler-pressure of 200 lbs. and 20,000 indicated horse-power, having a piston-speed of 900 feet per minute, and coal consumption of 1·4 pounds per indicated horse-power per hour. The speed ranges about 20 knots, and consumption 178·5 cwt. per hour, with a weight of machinery 485 lbs. per indicated horse-power (4830 tons), which, with fuel leaving port (3000 tons), absorbs about 44 per cent. of the 17,650 tons displacement, the indicated horse-power to displacement being 1·13.

In 1897 the North German Liner **Kaiser Wilhelm der Grosse** appeared with four-crank triple-expansion engines having four cylinders 52 inches, 89¾, and two of 96½ inches diameter and 5 feet 9 inches stroke, and boiler-pressure of 178 lbs. The indicated horse-power is 32,000, with a piston-speed of 950 feet per minute, and coal consumption of 1·4 lbs. per indicated horse-power per hour. The speed ranges about 22·8 knots, and consumption 442 cwt. per hour, with a machinery weight of 483 lbs. per indicated horse-power (nearly 6500 tons), which, with fuel leaving port (4000 tons), absorbs nearly 47 per cent. of the

displacement, 23,760 tons; the indicated horse-power to displacement ton is 1·3.

Following this powerful vessel, in June 1898, came one of the most novel and at the same time beautiful vessels of the Atlantic Ferry, namely, the **Kaiser Friedrich**, also for the North German Line.[1]

She was built by the firm of F. Schichau in Dantzig, which had hitherto devoted themselves more particularly to torpedo craft, and they have courageously adopted many of the designs of the machinery of the smaller vessels for this liner.

The vessel is 584 feet B. P. long by 64 broad and 41 deep, the gross tonnage 12,000, and has the passenger accommodation arranged after the style of the preceding boat; but the engines, which are quadruple, present an entirely new departure, being constructed without any cast-iron columns below the cylinders, their places being taken by round steel pillars well stayed and supported by diagonal bracing.

The cylinders, which are 43¼, 64¼, 92⅛ inches, and two low-pressure of 93¼ inches in diameter, with a stroke of 5 feet 9 inches, are placed as follows on the three cranks:—The No. 1 or high-pressure is placed tandem on top of one low-pressure cylinder on the forward crank; the No. 2 is tandem on top of the second low-pressure on the after crank, and the No. 3 (second intermediate) is

[1] Early in 1899 this vessel was withdrawn from the North German Lloyds on account of the speed being unsatisfactory, and in August of that year the builders announced that she was to sail in future as a Hamburg-American Liner.

on the middle crank, both engines (port and starboard) being alike. The crank-shafts are each in three separate pieces of the hollow solid type not built up, the superiority of the nickel steel being such as to allow of the adoption of this design.

Another great departure in the machinery is the placing of one set of three boilers *abaft* the engines; this has been done in order to have the engines placed more amidships, which from experiment is found to reduce the vibration caused by the machinery.

There are nine boilers of the ordinary marine type, having forced draught, arranged three abreast; all have eight furnaces except the centre one aft, which has only six, the total number of furnaces with the auxiliary boiler being seventy-two, and the steam-pressure 225 lbs. per square inch.

This handsome craft, which is arranged with two masts and three lofty funnels, has a speed of nearly 22 knots, and the indicated horse-power is 27,000, with a piston-speed of 980 feet per minute, and coal consumption of 1·37 pounds per indicated horse-power; the fuel consumption per hour reaches 330 cwt., and the machinery weight 476 pounds per indicated horse-power (5740 tons), which, with fuel leaving port (3500 tons), absorbs close on 46 per cent. of the displacement (20,100 tons); the indicated horse-power to displacement ton is 1·3.

Since these fast and powerful vessels came upon the scene no further advances have been made as regards speed, but, as already noticed, the Hamburg-American Line have contracted for an even more powerful and

faster vessel than either of the North German boats or the White Star Liner **Oceanic.**

With a view of showing in a ready form the gradual advances made in the efficiency of the machinery of Atlantic Liners, the author has arranged the following tables, and prepared the simple diagram to show it in a graphic form.

TABLE I.

PADDLE VESSELS.

Year.	Displacement.	Knots Propelled.	Indicated Horse-power to Displacement Ton.	Fuel per Indicated Horse-power.
1819	1,850 Tons	6 Knots	·0048	10 Pounds
1838	1,980 "	8	·03	6·5 "
1840	2,050 "	8½ "	·036	4·7 "
1850	6,500 "	11½ "	·3	4 "
1856	8,700 "	13½ "	·46	3·07 "
		SCREW VESSELS.		
1850	2,910 Tons	9 Knots	·27	6 Pounds
1854	3,200 "	10 "	·36	4·5 "
1861	4,950 "	11¾ "	·33	4 "
1871	7,100 "	12½ "	·4	2·1 "
1881	12,300 "	17 "	1	2 "
1885	13,300 "	19 "	1·06	2 "
1887	17,270 "	20·8 "	1·07	1·6 "
1892	20,000 "	22 "	1·5	1·4 "

Diagram Illustrating Results Obtained
on Cargo Steamers for
One Pound of Fuel Consumed.

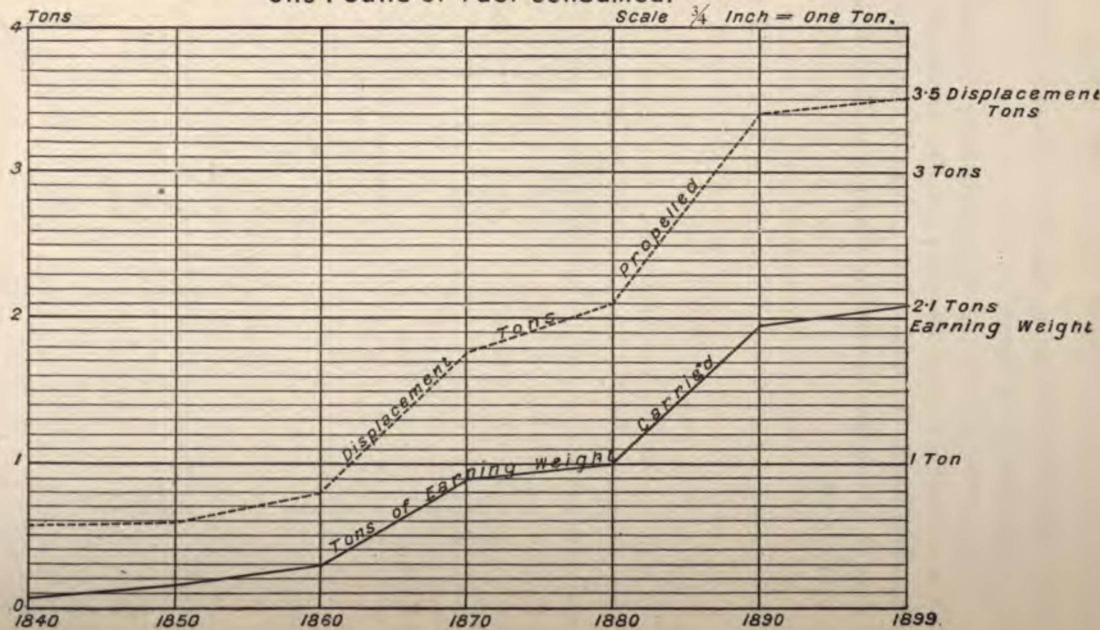


TABLE II.

Year.	Machinery Weight, Pounds per Indicated Horse-power.	Piston-speed, Feet per Minute.	Displacement Tons.	Displacement Absorbed by Propelling Power, %.	Indicated Horse-power
PADDLE VESSELS.					
1828	1,500	170	2,300	46 %	700
1862	1,000	360	8,755	40 %	4,000
SCREW VESSELS.					
1850	1,200	200	2,910	42 %	800
1861	800	300	4,500	34 %	1,500
1871	490	530	7,100	22 %	3,000
1881	490	680	12,300	40 %	12,000
1891	480	860	17,270	39 %	18,800
1893	490	1,000	20,000	47 %	30,000
1898	480	1,000	23,760	47 %	32,000

By this it will be seen that high piston-speed, which practically retarded the adoption of the direct-acting screw engine in early days, has increased, and is increasing, far beyond expectations. This must be viewed with satisfaction, as it is the great factor in the gaining of even greater horse-power in the future, which, as already noticed, will be looked for immediately on the production of a more efficient boiler. The proportion of displacement absorbed by the weight of the machinery and fuel shows in a marked degree the magnitude of the machinery now

required, notwithstanding the very substantial reduction in weight per indicated horse-power, but, at the same time, it is remarkable that the displacement absorbed by the machinery and fuel of the **Kaiser Wilhelm der Grosse** is almost the same as in the liners of 1838, and something

ENGINES OF THE OCEANIC.

less than in 1840, namely, 47 per cent.: but if the 32,000 indicated horse-power engines of to-day were to be built upon the weights prevailing in 1840, the machinery alone would nearly approach the whole of the displacement of that vessel (**K. W. D. G.**), as it would reach 21,500 tons, and would require a consumption of something over 1600 tons per twenty-four hours.

It is remarkable that since the introduction of the three- and four-crank engine, the number of disablements through the breakage of crank or tunnel-shafts has been considerably reduced during the last seventeen years, and the wonderful immunity from breakdowns which characterizes the vessels of the Atlantic Ferry is worthy of notice, although the voyage is admittedly the wildest and most trying in the world.

Taking the year 1898, although there were over 5000 sailings from ports on each side of the Atlantic, only fifteen breakdowns of machinery could be traced which caused serious delay, and only five total disablements.

Such a gratifying condition of things, even in this age of unique achievements, is worthy of note, and, although redounding to the credit of both builders and owners in proving that the best designs, materials, and workmanship have been utilized, it would be idle to deny that, were it not for the care and attention taken and given by the engineers at sea, the men who bear the heat and brunt of the day, from the chief downwards, the result would not be so satisfactory, nor the advances which have been made become practicable.

The readiness and aptitude of these engineers to adapt themselves to all the numerous demands made upon them by increasing improvements and refinements can be conceived, when it is borne in mind that the following extensive additions have been made to their duties since 1878, when, as already noticed, the indicated horse-power was under 6000—namely, double bottom ships with their elaborate pipe and pumping arrangements, electric-light

machinery with motors and connections, refrigerating gear of all kinds and sorts, independent steam-pumps for every possible use, fan engines for forced draught, ventilating engines, and, lastly, the multiplication of the propelling machinery, as where there formerly existed but two crank-pins and two sets of cylinders and valves, there are now eight crank-pins and ten sets of cylinders and valves.

These, added to the increased number of boilers and their attachments, must be seen to be realized, and yet in every case, thanks to their intelligent ability and close attention to duty, each new liner as a rule represents a still further advance upon those which have gone before.

In describing the improvements made in the machinery of the express liners, it is remarkable what little advance has taken place of late years in the design of boilers, and it may not be out of place to here glance back upon the development of that important factor. In early days but little knowledge of boiler-making existed, and iron plate construction work generally was but little understood, and as there were practically no tools to help the manual labour, it may be readily conceived that low steam pressures followed as a necessity.

The following remarkable quotations from a technical book of the period, showing how difficult it was to make ironwork absolutely tight, will be read with interest—

"In iron boilers, when water is first admitted after construction, hundreds of weeps or channels in the plates and rivets where water oozes are totally disregarded, the most important only being stopped mechanically; the rest are stanched merely by the rust the water has formed in its passage, and, the bulk of oxide being greater than

that of the original material, lingers where it is formed, and thus becomes a perfect iron cement, and the boiler tight."

Being the easiest to construct, the rectangular flue boiler was generally adopted, and so long as the pressures were low it answered its purpose, but to the engineers of to-day it almost sounds like a dream to be told that a reverse valve must be fitted to each boiler to prevent a vacuum in the boiler, when the steam was low, which might cause it to collapse if it fell below atmospheric pressure. A peculiar addition to the machinery fitted to the **Great Western** was pumps working constantly, pumping the water out of the boilers into the sea to prevent undue accumulation of scale—a system which was continued for many years afterwards in the low-pressure days under the name of blowing off or brining.

Almost the first successful change which was made from the flat-sided flue boilers was that already noticed as being introduced by the Americans on the Collins liners **Atlantic** and **Arctic**, in 1849 and 1850. These were constructed a rectangular shape, of plates $\frac{3}{8}$-inch thick, having 1400 tubes in each boiler, 2 inches external diameter, fastened by expanding at ends as at present, but the tubes were placed vertically, having the water inside and the flame around them outside. Although these boilers gave good results, they never found favour with the English engineers; those adopted in this country were the boilers which are still extant for low pressure, namely, the rectangular multitubular boiler, with the tubes placed horizontally. This design of boiler was introduced on the Atlantic in 1852 on the Cunard **Arabia**, the difficulty experienced in keep-

ing the flue boiler tight and in order, at the higher pressures of 15 and 20 lbs. then coming into vogue, being very considerable. These boilers were built in two ways—one with the wet bottom, as it was called, owing to the furnaces having the water under them, and the other the dry bottom, in which the water space terminated at the sides of each furnace, so that the furnaces were altogether open at the bottom, which required an ash-plate to be fitted. This design of boiler answered its purpose admirably with pressures up to about 30 to 40 lbs., but towards 1867, owing to still increasing pressures, the now well-known cylindrical boiler, with internal furnaces and return horizontal tubes, came into use, and, with numerous varieties of combustion chamber arrangements, has since become universally adopted in the Merchant Service, either as single or double-ended, and oftentimes modified to an oval shape. The question of superheaters, which in the low-pressure days was so much talked of, has passed into oblivion, and owing to the high pressure now prevailing is not likely to be revived.

As regards the placing of the boilers on board ship many systems have been adopted. In the early days the boilers were placed back to back, with furnaces fired fore and aft; later, one set of boilers were placed abaft the paddle engines, and another set forward, thus requiring two funnels. Another system was to place the boilers on each side of the ship, with the backs to the ship's side, so that all the furnaces were fired athwartship from one long stokehole. Since the introduction of the double-ended boilers, however, the general plan of placing them so that

the furnaces are fired fore and aft has been adopted, and on large vessels this arrangement adapts itself well to the numerous bulkhead divisions.

The heaviest plates used in the shells of *iron* boilers were those on the **Wyoming** and **Wisconsin**, which were $1\frac{1}{4}$ inches thick, the boilers being each $16\frac{1}{2}$ feet diameter by 23 feet long, with ten furnaces in each, all opening to one combustion chamber; but owing to improved appliances and the high pressure of to-day, shell plates of $1\frac{5}{8}$ inches steel have been used, steel having come into use for marine boiler-making since 1876.

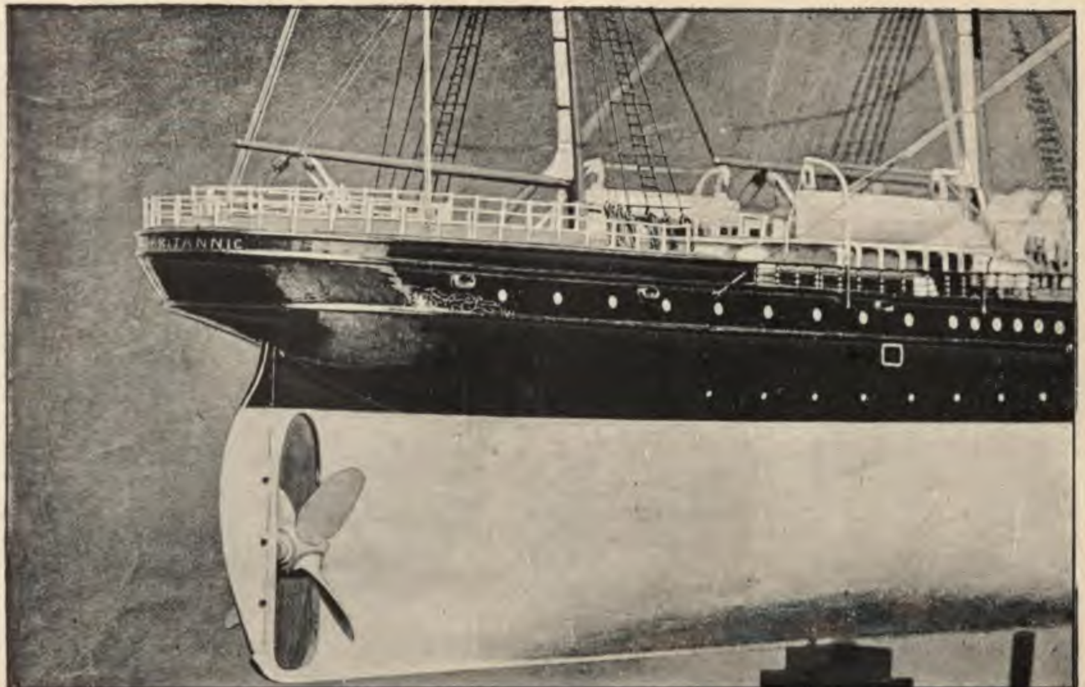
From the introduction, in 1868, of the cylindrical boiler now in general use down to the present day, practically no change or advancement in its efficiency has been effected to any degree, the alterations or improvements in the details, as instanced in the adoption of the Serve tube, and also in design of furnace, which, by being corrugated or ribbed, practically brought the triple- and quadruple-expansion engines into use, as they readily allow higher pressures to be carried in the cylindrical internal flue boiler, thus avoiding any radical change in their design.

Notwithstanding that water-tube boilers have to a great extent been adopted in the Royal Navy on all classes of vessels, they have not yet been fitted on any of the Express Liners of the Atlantic Ferry, although a trial has been made on at least one cargo vessel. Owing to the use of high-pressure steam rendering it necessary to pay particular attention to the feeding and general working of boilers at sea, no liner now-a-days is without evaporators, feed-heaters,

and feed-filters. By the use of these various appliances, practically pure distilled water only is now used at sea, and as this removes one of the great obstacles to successful working of water-tube boilers, it only remains for another advance to be made. It is, however, to be hoped that the same immunity from boiler explosions may be experienced in future, as in the past six decades of the Atlantic service, as no explosion has been recorded, although a few lives have been lost in minor failures.

One other section of marine engineering, like the boiler, has practically undergone no change since its first use on the old side-wheel **British Queen** in 1838—that is, the surface-condenser, the arrangement and design being the same to-day, with slight improvements in packing the tubes. The condensing water is also circulated by pumps now generally of the centrifugal type. Up to date no attempts have been made, except on very small vessels, to utilize the motion of the ship through the water to cause the circulation, as was tried in former years. The only radical change is that, in order to reduce the weights, the shells of the condensers are now of either brass or copper, the former being most used.

The introduction of the electric light, electric motors, forced draught, and refrigerating engines, has added many extraneous machines to the modern engine-room, and in the development of these auxiliary engines their construction has become a speciality of many firms, with the result that they are all of superior make, and do their work most satisfactorily, requiring but average care to keep them in order at sea.



STERN OF SINGLE-SCREW STEAMER.

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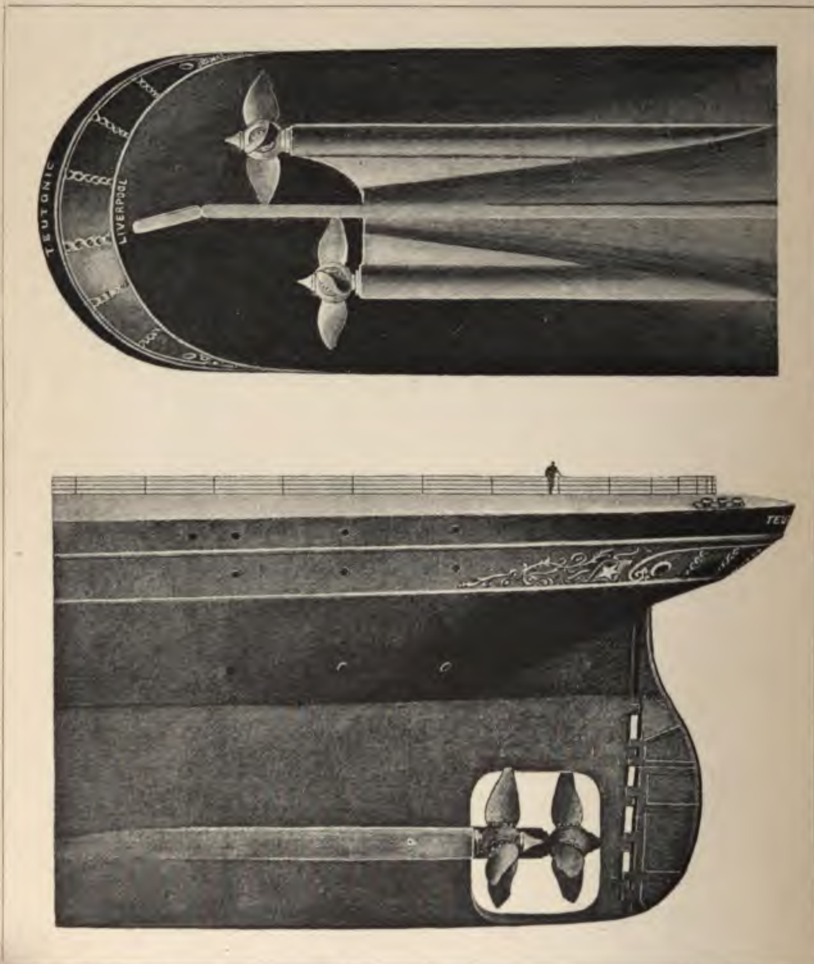


STERN OF TWIN-SCREW STEAMERS TEUTONIC AND MAJESTIC,
SHOWING OVERLAPPING PROPELLERS.

[*To face page* 105.

Since the advent of the twin screws a great alteration has been made in the arrangements of the stern, from that prevailing with the single, which is shown on illustration (p. 194), and which is still in extensive use, and likely to be retained for many years to come owing to its simplicity, when but moderate power and speed are required.

The other system is the overlapping propellers, which necessitates a screw port, as in the single-screw arrangement, but as this opening is no disadvantage, and the advantages of the design and the results obtained have been satisfactory, it continues to be extensively adopted. The arrangement of the after part of the hull, as may be seen from the illustration on next page, is so designed that it is built with the frame and shell-plating projecting outwards in the wake of the shafts, which forms a convenient recess inside the ship for the shafts; it also possesses the great advantage of allowing the stern-tube to be fitted exactly as in the single-screw arrangements, which gives a desirable support to the shaft and propeller, besides keeping everything as far as possible secure from danger.

The designs of the propeller, like those of the boiler, have practically undergone but little change during the past fifteen years, the system of blades bolted on to the propeller boss being now universally adopted for the express steamers; the material generally used for the blades is manganese bronze, and for the bosses cast-steel or cast-iron. Up to the present the largest propellers yet made have been those on the **Umbria** and **Etruria**; these

are 24½ feet diameter, 33½ feet pitch, 216 square feet surface, and weigh about thirty-nine tons each, each blade being about seven tons. Of late the number of blades has been reduced on the twin-screw vessels from four to three, which has given a slight improvement.

When it is remembered that the cost of the manganese bronze for the propeller blades then averaged about £120 per ton, some idea of the cost of the machinery of the great liners may be formed, the four blades for one of these steamers costing £3360, and the boss about another £1000, so that the total cost of the propeller alone, fitted in place, is but little under £5000.

One of the numerous requirements necessitated of late years in the engine-room, owing to the great advance of the steam-pressure, is the "Evaporator" as it is termed. This is required to make up the supply of fresh water for the boilers, and is generally worked by the passing of steam through coils of pipes immersed in sea-water, and so boiling it, the steam being collected and passed into the boilers with the ordinary feed-water. The other feature of special note in connection with the modern machinery is the application of forced draught, which is now extensively adopted.[1] The two systems so far tried on the Atlantic are the closed stokehole principle, when the air is raised to a pressure in the stokehole by means of fans, and

[1] The term forced draught is used when artificial means are adopted either by means of steam-jets as on a locomotive, or by forming a partial vacuum in the funnel, or by fans blowing or forcing air into the fires. The first record of forced draught by fans is that of the famous engineer John Ericsson, who fitted it on the steamer **Corsair** in 1830, and later in the U.S. warship **Princeton** in 1843.

allowed to flow direct through the fires, so forcing the combustion. This principle has been extensively adopted by the various navies, but has been practically found wanting in the heavy Express Transatlantic Service.

The other principle is the one named after Mr. Howden, and was first introduced to the Atlantic on the steamship **Ohio**, followed soon afterwards by the White Star Liner **Celtic**. The results on those vessels were such as to induce the fitting of it since on an extensive scale by many Atlantic and other liners, amongst them being the **Paris**, where it was fitted in lieu of the closed stokehole system, when the new machinery was fitted on board after the breakdown. Another system of artificial draught is a combination of several older forms, termed induced draught, and is now fitted on several Atlantic Liners.

In order to show more fully the enormous commercial value of improvements in both steamship hulls and machinery, it is only necessary to give the following particulars, which the author brought forward in his inaugural address as President of the Liverpool Engineering Society in October 1895, by which the results obtained from the consumption of one pound of coal on board ship are readily perceived.

In 1840 one pound of coal propelled ·578 displacement ton at the rate of 8 knots, of which ·057 ton was earning weight.

In 1850 one pound of coal propelled ·6 displacement ton at the rate of 9 knots, of which ·16 ton was earning weight.

In 1860 one pound of coal propelled ·82 displacement ton at the rate of 10 knots, of which ·27 ton was earning weight.

In 1870 one pound of coal propelled 1·8 displacement tons at the rate of 10 knots, of which ·9 ton was earning weight.

In 1880 one pound of coal propelled 2·1 displacement tons at the rate of 10 knots, of which 1·05 tons was earning weight.

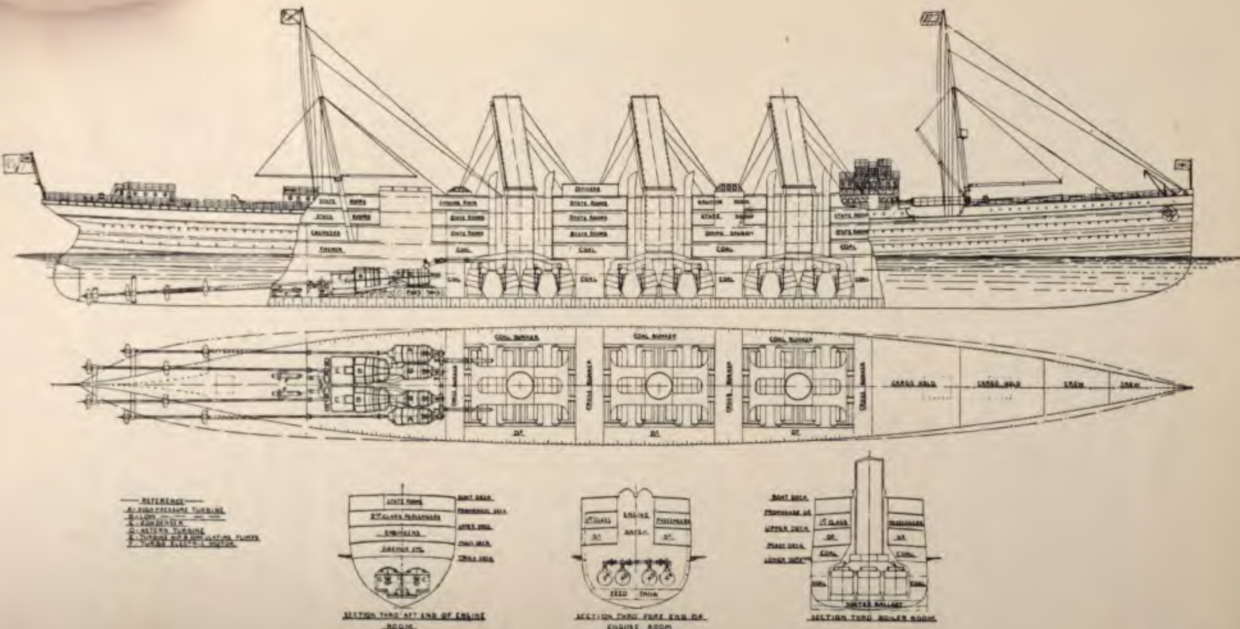
In 1890 one pound of coal propelled 3·33 displacement tons at the rate of 10 knots, of which 1·93 tons was earning weight.

In 1898 one pound of coal propelled 3·5 displacement tons at the rate of 10 knots, of which 2·1 tons was earning weight.

Coming to Express Liners, it will only be necessary to give in a tabulated form the various particulars of the actual performances of typical boats reduced to terms of the triple engine, in order to see the increase of machinery required for high speed.

Year.	Steamer.	Displacement Tons.	Speed, Knots.	Coal per hour, Tons.	Indicated Horse-power.
1883	Oregon . . .	12,500	19	9·4	12,000
1885	Umbria . .	13,300	$19\frac{1}{2}$	10·1	14,500
1889	Teutonic . .	16,740	20	12·	18,000
1893	Campania . .	21,000	22	20	30,000
1897	K. W. D. Grosse	23,760	22·8	21·2	32,000

Although not yet come within the range of actual fact on the Atlantic Ferry, it may not be out of place to here make mention of what may be one of the great changes looming in the near future. This consists in an entirely new departure in the design of propelling machinery for all classes of vessels, which has been brought forward under the name of the turbine system; the first successful example of this being a small torpedo type of boat measuring 100 feet long, by 9 broad, with 1500 indicated horse-power, named the **Turbinia**, which appeared at the



PROPOSED ATLANTIC LINER.

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Naval Review of 1897, and attained a speed of 34½ knots per hour.

Encouraged by the success of this boat, others have been constructed on a larger scale for the British Government, and the inventor, the Hon. C. A. Parsons, now proposes the application of the principle to an Atlantic Liner, the particulars of which, as published in *Engineering*, are, length 600 feet, by 63·3 feet broad, and 42 feet deep, with a displacement of about 18,000 tons, and about 28 feet draught of water, and an estimated speed of about 26 knots.

For a vessel of this size and speed he estimates that 38,000 indicated horse-power will be required, and that the total weight of the turbine machinery and water-tube boilers working four small propellers specially designed for the high speed of revolution, will be under 2500 tons, which will mean an enormous saving on the weights prevailing for the type of marine engine now in vogue, and it is to be hoped, for the further improvement of large ocean-going passenger vessels, that these anticipations will be fully realized.

CHAPTER XII.

THE MEN WHO HAVE MADE AND CONDUCT THE ATLANTIC FERRY.

TURNING now from the general doings of the great vessels and lines, it will be interesting to recall the individuals whose names have become for ever fixed in the pages of maritime history, and of whom many have now "gone down to rest." Among the first of these was SIR SAMUEL CUNARD, the founder of the great line now bearing his name, who was born in Newfoundland in November 1787, and was there representing the great East India Company in Halifax, when he was attracted by the advertisement of the English Admiralty for the mail service across the Atlantic. Shortly afterwards (in 1838) he came to England, and having received an introduction to, he met and consulted with Mr. Robert Napier, of Glasgow, who in turn introduced him to Mr. G. Burns and Mr. David MacIver, which resulted in the line being founded and the contract signed by the three names, Samuel Cunard, George Burns, and David MacIver, and was continued by the joint firms of Cunard, Burns, and MacIver until Sir Samuel's death in London on April 28th, 1865.

SIR SAMUEL CUNARD, BART. [*To face page* 200.

BORN 1787, DIED 1865.

ONE OF THE FOUNDERS OF THE CUNARD LINE. JOINT SIGNER OF FIRST ADMIRALTY MAIL CONTRACT.

SIR GEORGE BURNS, BART. [To face page 201.

BORN 1795, DIED 1890.

ONE OF THE FOUNDERS OF THE CUNARD LINE. JOINT SIGNER OF FIRST ADMIRALTY MAIL CONTRACT.

Mr. George Burns, who was associated with Mr. Cunard, was born in the neighbourhood of Glasgow in the year 1795, and in 1818 commenced business as a general merchant with his brother James in Glasgow. A few years afterwards he took over a fleet of sailing coasting vessels to Liverpool and elsewhere, and commenced with steamers to Belfast in the same year, 1824. Following the usual course, steam was substituted on the Liverpool line, and a fusion made with Messrs. MacIver, of Liverpool. After the founding of the Cunard Line, Mr. George Burns resided in Glasgow, looking after the interest of the line there, and also the extensive coasting trade, and eventually retired from business in 1860, from which time up to his death he resided at Wemyss Bay, on the river Clyde. In May 1889, he was created a baronet, and died the following year on June 2nd, 1890, aged ninety-five years.

David MacIver, the other signatory to the contract with the Admiralty for carrying the mails, was born in Scotland in 1807, and was brought up in the office of the American Consul in Greenock. Together with his younger brother Charles he founded the well-known firm in Liverpool of D. and C. MacIver, which took charge of the Liverpool business of the Cunard Line, together with their other services, and was successfully carried on by them together until his death in 1845, aged only thirty-eight years.

The other great name which must be associated with this splendid enterprise was that of Mr. Robert Napier, the engineer, who practically rendered the venture a

success, as his far-seeing judgment in designing and using the best-known systems of marine engineering, prevented any breakdown or failures of machinery, which would have damaged the reputation and success of the line. He was born at Dumbarton on June 18th, 1791, and commenced business in May 1815, by purchasing a small blacksmith's shop in Glasgow. Some years afterwards, in 1823, he made his first marine engine for a

MR. ROBERT NAPIER.

INTRODUCER OF SIDE-LEVER ENGINES. BORN 1791, DIED 1876.

Clyde steamer, and continued afterwards making numerous engines for other boats down to 1839, when he made the engines for the Atlantic steamer **British Queen**, and also for the first four Cunard steamers, the connection with that firm being then formed. Amongst noted vessels engined by him was the old three-decker **Duke of Wellington**, the last of England's wooden walls; and he also built the

SIR DAVID MACIVER. [*To face page* 202.
BORN 1807, DIED 1845.

CUNARD LINE. JOINT SIGNER OF FIRST ADMIRALTY MAIL CONTRACT.

second of the English armour-clads, the **Black Prince**, which was engined by Penn. He died on June 22nd, 1876, aged eighty-five.

Amongst the names deserving a place on the roll of honour connected with the Transatlantic Service is that of Mr. E. K. COLLINS, the patriotic American who endeavoured in the earlier days of the trade to secure for his country a foremost place in the great steamship enterprises then just developing.

Mr. Collins was a native of Truro, Massachusetts, where he was born on August 5th, 1802. He commenced his business career at the age of fifteen, in New York City, and after a few years' service as junior, he was engaged by a firm of West Indian merchants, and was employed as purser—or, as it was then styled, supercargo—on board the vessels, where he had occasionally some exciting adventures with the numerous pirates then roving about those islands.

Some years afterwards, in 1822, he joined his father in the general shipping and commission business, and eventually became head of the firm, which he then commenced to develop extensively, first by putting fine full-rigged sailing ships on the West Indian and Mexican trade from New York; and later, in 1836, by establishing the splendid service of sailing packets between New York and Liverpool, known as the Dramatic Line, on account of all the vessels having theatrical names, such as the **Shakespeare, Garrick**, etc. A noted departure in these fine vessels, besides their superior internal fittings, was the total abandonment of the fine-lined vessel having a

sharp rise of floor, and the substitution for it (against the opinions of the noted New York shipbuilders) of the flat-floored form of hull.

MR. E. K. COLLINS.
FOUNDER OF THE COLLINS LINE. BORN 1802, DIED 1878.

Like the other owners of the Transatlantic sailing liners, Mr. Collins watched with keen interest the working of the earlier British Atlantic steamers, and having

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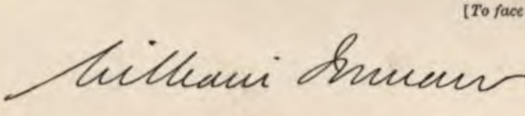
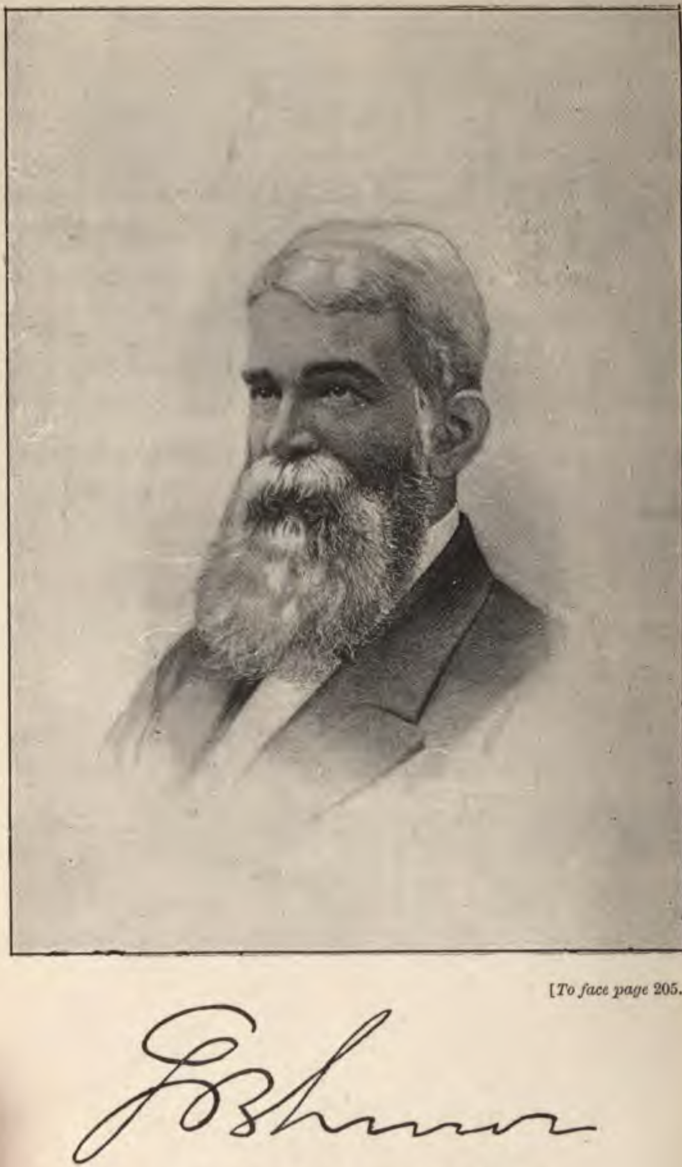


FOUNDER OF INMAN LINE. BORN 1825, DIED 1881.



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FOUNDER OF GUION LINE. BORN 1819, DIED 1885.

satisfied himself that they would prove rivals to the sailers, he endeavoured at an early date, but without any success, to induce the United States Government to assist in promoting a line of American-built and owned steamers, so as to be available for naval service.

His early appreciation of the utility of steamers was fully shown by a conversation he had with some friends on board one of his own sailers early in 1841, when seeing the ill-fated **President** steam past, he declared "that he would do his utmost to promote a line of steamers to cross to Liverpool in ten days." But as already noted, owing to the delay of the United States Government, it was not until 1847, when the Act was passed by Congress, that he was in a position actually to commence the formation of the steamship line bearing his name, and which three years afterwards, in 1850, commenced with the **Atlantic**, **Arctic**, **Baltic**, **Pacific.**

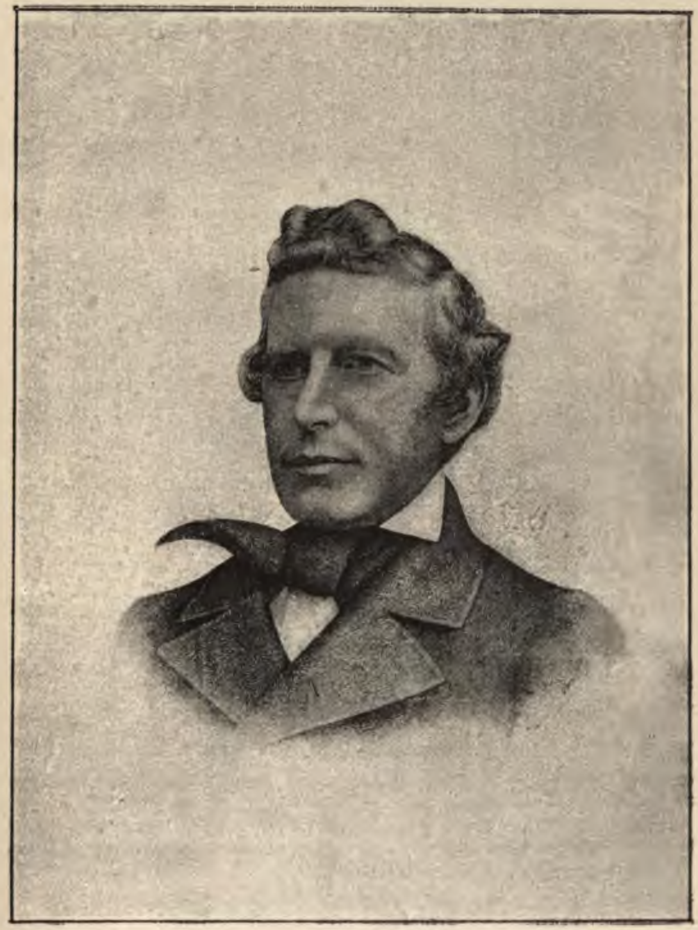
Upon the withdrawal of the steamers early in 1858, he turned his attention to other matters, and died in New York in January, 1878.

Mr. WILLIAM INMAN, the founder of the line which bore his name for forty-two years, was born at Leicester on April 6th, 1825, and was son of Mr. Charles Inman (a partner in the firm of Pickford and Co., the carriers), who having retired from that firm, came to Liverpool. Here his son William completed his education, and eventually became a partner in the firm of Richardson Brothers, in conjunction with whom he first promoted the steamship service, which he afterwards made so famous. This he successfully conducted until his death, in his fifty-sixth year,

at Upton, his Cheshire residence, on July 3rd, 1881, shortly after the launch, and before the advent of, the beautiful **City of Rome**, the last vessel ordered by him.

Mr. STEPHEN BARKER GUION, the founder of the Guion Line, was of American birth, and came to Liverpool, about the year 1851, in connection with the steerage passenger trade of the Black Star Line of sailing ships, which he extensively developed. After a short connection, as agent, with the Cunard Company for the purpose of working up the steerage passenger traffic, followed by a similar connection with the National Line, he founded his own line in 1866, and successfully carried it on until shortly before his death. This took place on December 19th, 1885, in his sixty-sixth year, at Liverpool, where he was widely known and respected, having occupied several public positions with great credit and ability.

Mr. CHARLES MACIVER was born in Glasgow in the year 1811, and was early connected with his brothers in the shipping business, and on the death of his brother David he retained the sole management of the Liverpool branch of the line, which he conducted very energetically, the vessels of the Cunard Line being generally known in Liverpool as MacIver's boats. During the early days of the volunteer movement he raised a corps amongst the Cunard Line staff in Liverpool, and became colonel of it. In 1882 he retired from the line, not being in unison with his co-directors as to the future working of the concern, which was then feeling the rivalry of the other lines, and died a few years afterwards, in 1885, aged



MR. CHARLES MACIVER. [*To face page* 206.

CUNARD LINE. BORN 1811, DIED 1885.

LORD INVERCLYDE.

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CHAIRMAN OF CUNARD LINE. BORN 1829.

seventy-four, at Malta, where he, for some time previously, had been in the habit of spending the winter.

One of the most prominent men, known for many years as SIR JOHN BURNS, still continues to pilot the Cunard Line, but having been raised to the peerage in the Diamond Jubilee year, 1897, he is now known as Lord Inverclyde of Wemyss Castle. Lord Inverclyde is the eldest son of the late Sir George Burns, of Wemyss Bay, and was born in Glasgow in 1829. After going through the University of his native city, he entered his father's office in Glasgow, and since that time has been directly connected with steamships.

Upon the retirement of his father in 1860 he became actively engaged in the Cunard Line, and was appointed Chairman of the Company on its formation in 1880, and still rules its destinies. He has also written several papers on nautical questions, one of the best known being that on "The Adaptation of Merchant Steamers for War Purposes."

One feature to be noticed is the great and active interest which his lordship takes in many of the benevolent institutions of the great city on the Clyde, amongst the principal being the industrial training ship **Empress**, formerly H.M.S. **Cumberland**.

SIR WILLIAM PEARCE was born at Chatham, on January 8th, 1833, where he was afterwards trained in the dockyard, and from there passed to the Clyde and became manager of Napier's Yard; after a few years there he moved to Fairfield, and in 1870, after the death of John Elder, he formed the firm of John Elder and Co., and later in 1878 became the sole partner.

After this event he launched into extensive ventures in steam navigation, and built the **Arizona, Etruria, Umbria**, and other noted vessels before his death, which took place in 1889.

The late Mr. T. H. ISMAY, founder and managing director of the White Star Line, was born at Maryport in the year 1837, and came to Liverpool in 1852, as an apprentice to a shipping firm, Imrie, Tomlinson, and Co. After visiting South America he joined, as junior partner, in 1860, the firm of P. Nelson and Co., and in 1864 became one of the directors of the National Line, then enjoying great prosperity. In 1866 he acquired the business of the then famed White Star Line sailing fleet to Australia, having previously commenced business on his own account.

In 1869 he formed the White Star Line of steamers, and in 1870 was joined by Mr. Imrie, the son of the senior partner of the firm in whose office he served his articles. From that time he succeeded in placing his line of steamers at the head of the great shipping concerns of Great Britain; and in 1892 he retired from the firm, but retained his interest and the position of Chairman of the line until his death, which took place on November 23, 1899, at his Cheshire residence, Dawpool, soon after the coming of the last great liner, the **Oceanic**, ordered by him. He was also a director of the Royal Insurance Company, and of the London and North-Western Railway Company, and served on several Royal Commissions.

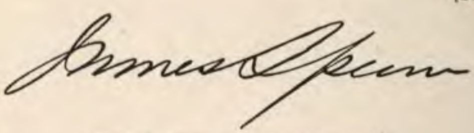
He rendered good service in recommending the excellent arrangements in 1878, by which the Government was enabled to directly connect the fastest steamers of all

[To face page 208.

Tho. H. Ismay

FOUNDER OF WHITE STAR LINE. BORN 1837, DIED 1899.

[*To face page* 20[illegible].



AMERICAN LINE. BORN 1829, DIED 1893.

the great lines with the Royal Navy, for service in time of war, though they were not acted upon until some years later in 1887. In the same year he handed over the sum of £20,000, as a nucleus for a fund for the support of aged and indigent merchant seamen, to commemorate the occurrence of his fiftieth birthday in the Jubilee year of her Majesty Queen Victoria, in 1887.

The late Mr. JAMES SPENCE was born in the north of Ireland in 1829, and received his early training in Philadelphia, under his uncle, Mr. Clarke, who was one of the partners in the firm of Richardson, Watson and Co., of that city. This firm then owned an excellent line of packet ships, trading between that port and Liverpool, the agents or consignees in the latter port being Richardson Brothers, which later on commenced the line known as the Inman.

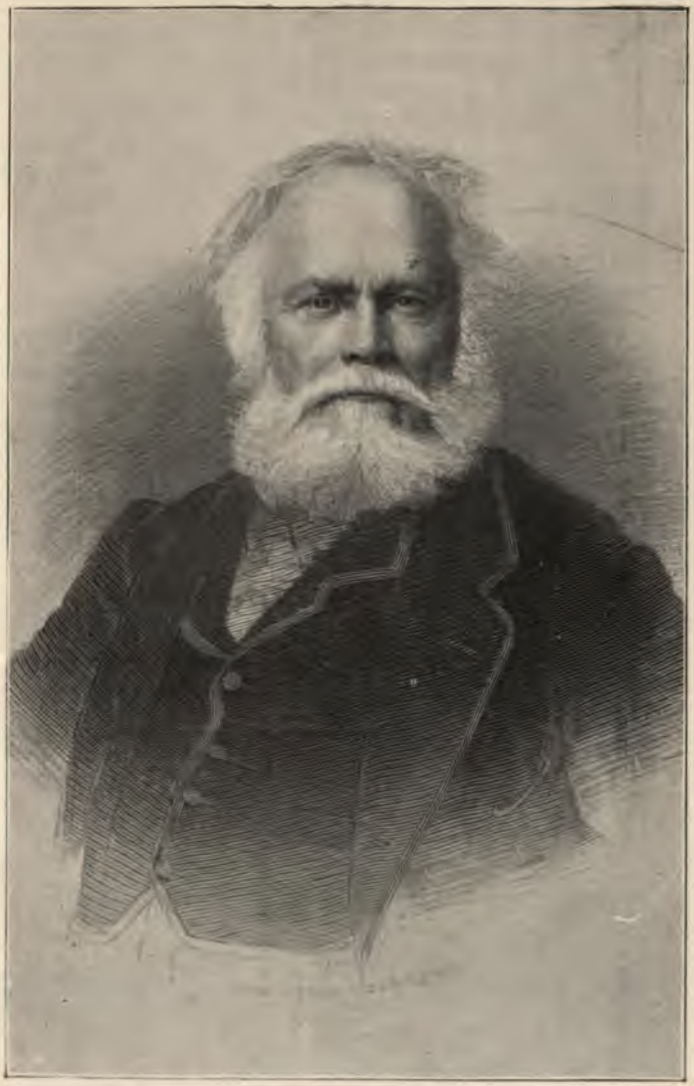
In 1854 Mr. Spence returned to England, and founded the firm now known as Richardson, Spence and Co., in connection with Thomas Richardson and Co. of New York and Philadelphia. In 1872 they became agents and managers in Europe for the American Steamship Company, better known as the American Line to Philadelphia.

In 1885 a further extension of the firm took place, in the acquisition of the Inman Line, which had been absorbed by the International Company of America, and has since been changed to the American Line from Southampton. This accession was mainly carried through by his partner, Mr. Edmund Taylor, who had been associated with Mr. Spence from the commencement as manager and partner.

After a career of nearly forty years in Liverpool, during which time he won the respect and esteem of all with whom he came in contact, he died rather unexpectedly in Edinburgh on December 20th, 1893.

One famous name on the Atlantic Ferry is that of SIR HUGH ALLAN, the founder of the Allan Line, who was the second son of a sea-captain, and was born at Saltcoats, Ayrshire, Scotland, in September 1810. He arrived in Montreal (then only a small town) in the year 1826, where he accepted what work he could get, but eventually became a clerk in a shipping house, Miller and Edmondson, and gradually rose to be partner. Some years afterwards, in 1852, he conceived the idea of forming a line of steamers to the mother country, and after visiting his native land and obtaining the assistance of his brothers in Glasgow and Liverpool, he formed the Montreal Ocean Steamship Company, which commenced (as noticed on p. 72) in 1854. Notwithstanding the interruption of the line by the vessels having been taken by Government during the Crimean War, and also several severe losses by shipwreck, the undertaking was successful, and Mr. Allan, as he was then, found time and capital to devote to other pursuits. Through his influence and ability he founded flourishing companies, both banking, railway, telegraph, steamship and others, and out of his private means provided Montreal (his adopted city) with public buildings of great interest and utility.

After a long and in every way useful career, Sir Hugh died in Edinburgh in 1884, when on a visit to the old country.



SIR HUGH ALLAN. [To face page 210.

BORN 1810, DIED 1884.

FOUNDER OF THE ALLAN LINE.

MR. CLEMENT A. GRISCOM. [To face page 211.
CHAIRMAN OF AMERICAN LINE. BORN 1841.

Amongst other prominent men known in recent years on the Atlantic Ferry is Mr. CLEMENT A. GRISCOM, the President of the American Line, or, to use its official title, the International Navigation Company of New Jersey, U. S. A.

Mr. Griscom was born in the Quaker City, Philadelphia, on March 15th, 1841, and after receiving his education in the High School and the Academy of the Society of Friends, he entered the office of the well-known Philadelphia shipping firm, Peter Wright and Sons.

In 1863 he was admitted a partner, and then turned his attention to steamships, at the same time studying Naval Architecture, and was later on elected to be the first President of the American Society of Naval Architects and Marine Engineers.

In 1871 Mr. Griscom was appointed Vice-President of the International Navigation Company, upon its establishment, and in 1881 he succeeded Mr. James A. Wright as President. Since that date the Company has extended its operations on a wide scale, and succeeded in floating the Stars and Stripes once more on many fine Atlantic Liners, and in addition he has gained for his line a controlling influence in the Red Star Line between Antwerp and New York, and the American Line from Liverpool.

Like most successful business men, Mr. Griscom has turned his attention to other commercial pursuits, and is a director of the Pennsylvania Railroad Company, the Bank of North America, and other insurance and industrial concerns; amongst the latter being the National Transit Petroleum

Company, which owns immense pipe lines and storage tanks.

SIR EDWARD JAMES HARLAND, Bart., founder of the great shipbuilding and engineering firm at Belfast, was a native of Scarborough, where he was born in 1831. After spending a few years at college in Edinburgh, he was apprenticed in 1846 to the firm of Robert Stephenson and Co., Newcastle-on-Tyne, who were extensive builders of locomotives, and also marine and land engines. Upon the completion of his articles, he entered the drawing office of J. and G. Thomson, Glasgow, where he was engaged until 1853, when he took over the management of a shipbuilding yard in Newcastle-on-Tyne, belonging to Messrs. Toward. After being there for a short time, he was offered a similar post in the Belfast shipyard, then owned by Robert Hickson and Co., which he accepted towards the end of 1854.

In the year 1858 the owner retired, and he became proprietor of the concern himself, and built his first vessel, the steamship **Venetian**, for Bibby, of Liverpool, which he launched early in 1859. In 1860, Mr. Wolff joined the firm, which has since achieved world-wide fame.

In 1885 Sir Edward Harland was elected Mayor of Belfast, and had been previously for some years Chairman of the Harbour Board, and was created a baronet of the United Kingdom in the year 1885. Some time afterwards, in 1889, he was elected Member of Parliament for one of the divisions of the city, which he retained together with his active interest in the firm until his rather sudden

[To face page 212.

E. J. Harland

OF MESSRS. HARLAND AND WOLFF, BELFAST. BORN 1831, DIED 1895.

RT. HON. W. J. PIRRIE. [*To face page* 213.

OF MESSRS. HARLAND AND WOLFF, BELFAST. BORN 1847.

death, which took place at his Irish residence, Glenfarn Hall, Enniskillen, on December 24th, 1895.

The extensive business is now carried on as a private limited company by Messrs. Wolff, Wilson, and Pirrie; the two latter of whom were amongst the first pupils trained by the firm.

The Right Hon. W. J. Pirrie is one of those who became prominent in this great traffic owing to his association with the White Star and other fleets which Harland and Wolff have so extensively built of late years. He was born in Quebec, in 1847, of Belfast parents, and has been all his life associated with that city, where he was educated at the Royal Academical Institution, and was afterwards apprenticed to Harland and Wolff in 1862.

Upon completion of his articles he was appointed to the important position of Chief Draughtsman, and in that post was associated with Mr. Edward Harland in designing the first **Oceanic**, during which period the author as a pupil had the pleasure of acting under them.

Later on, in 1874, when the senior partners entered into public life, Mr. Pirrie was taken into partnership (together with Mr. Walter H. Wilson), and since then the firm has risen to still greater prominence.

In 1896 he was elected Lord Mayor of Belfast, and after two brilliant years of office, he retired in order to pay closer attention to the business of his firm. In 1897 he was appointed a Privy Councillor of Ireland.

Turning to the Continent, mention must be made of the founder of the North German Lloyds Line, Herr Meier.

A native of Bremen, he spent the early portion of his

HERR MEIER. DIED 1898. [To face page 214.

FOUNDER OF THE NORTH GERMAN [illegible]NE.

life there, and was educated at Stuttgart, and in 1826 entered the office of his late father's firm, H. H. Meier and Co. of Bremen. After being there some years he became manager of the Boston (U. S. A.) house, and returned to Bremen some years later. In 1856 he turned his attention to the idea of forming a line of steamers to America, and in 1857 commenced the present service. The great success of the line and his own distinguished abilities soon placed Herr Meier in the foremost position, and as a member of the Reichstag he was able to render great public service, not only to his native city, but also to his country at large, until his death, which took place at Bremen on November 17th, 1898.

Mr. JAMES R. THOMSON, the former managing director of the great Clydebank establishment, was born in Glasgow in the year 1844, and received his training in the shipyard of his father and uncle, James and George Thomson, then situated between Glasgow and Govan.

He joined the firm as partner in the year 1868, and continued to guide its course in the same satisfactory way as his predecessors, assisted by his brother, Mr. George P. Thomson, until September 1899, when the firm was purchased by John Brown and Co., Sheffield, and the title of the works changed to that of the buyers.

Amongst the notable merchant vessels built by them may be mentioned the **Russia** and **Servia** for the Cunard Line; the high-speed **America** for the National Line; the **City of New York** and **City of Paris** for the Inman Line; and the **Friesland** for the Red Star Line of Antwerp.

HERR MEIER. DIED 1898. [To face page 214

FOUNDER OF THE NORTH GERMAN LLOYD LINE.

Magellan to the West Coast of America. In 1868 he became sole owner of the Fairfield Shipbuilding Yard, changing the firm to John Elder and Co., under which style it turned out some then well-known vessels. He died in London in 1869, at the early age of forty-five, leaving a large fortune to his widow, who generously applied it to promote the science of naval architecture and engineering, to which her husband personally contributed so much.

Amongst the numerous Clyde engineers who occupied a distinguished position must be mentioned the late Mr. ALEXANDER C. KIRK, LL.D., to whom belonged the honour of having made the now universally adopted triple-expansion engine a success.

Mr. Kirk was a native of Forfarshire, and was born in 1830. He received his technical training at the works of Robert Napier. Afterwards he entered the service of Young, Meldrum, and Binny in their paraffin oil works, and when there had his attention turned to the want of an effective means to maintain a low temperature throughout the summer months, which was required to extract the solid paraffin.

After careful study and experimenting, he eventually succeeded in producing the first successful refrigerating machine, which was later on developed by Bell, Coleman, and others.

In 1870 John Elder and Co. appointed him manager of their engineering works, from which time he was directly connected with marine engineering. In 1874 he designed and had built the first large triple-expansion engines for

MR. JOHN ELDER. [*To face page* 216.

INTRODUCER OF COMPOUND ENGINES. BORN 1824, DIED 1869.

[To face page 217.

Alexander Kirk

INTRODUCER OF TRIPLE-EXPANSION ENGINES. BORN 1830, DIED 1892.

the steamship **Propontis**, but owing to the failure of the boilers they were not successful.

Some years later, owing to the great improvements made in the manufacture of the ordinary marine boilers, which enabled higher pressures to be carried, he again turned his attention to the triple-expansion system, and in 1881 produced the steamship **Aberdeen**, which was a complete success, and was soon followed by others; so that, although triple engines had been previously made by the Ouseburn Engine Works, and the system was also used by Perkins, it is to Dr. Kirk that the credit must be given of being the first to make them a practical success. In 1877 he joined the firm of R. Napier and Sons, Glasgow, as senior partner, which he occupied until his death, which took place rather suddenly in Glasgow on October 5th, 1892.

Another eminent name directly connected with the Atlantic Ferry was that of Mr. DAVID TOD, the principal partner of Tod and MacGregor, formerly famous shipbuilders and engineers of Glasgow. As already noted, it was Mr. Tod who induced Mr. Inman when forming his line of steamers to adopt the screw-propeller and iron hulls, the latter of which he was the first to commence building as a regular business.

Mr. Tod was born at Scone, Perthshire, and served his apprenticeship to a country wheelwright, and subsequently entered the workshop of Mr. David Napier, which turned his attention to the steamship trade.

He was engineer on board the **Rob Roy**, the first steamer to cross the Channel to Belfast in 1818, and afterwards on other larger vessels.

After the regular commencement of the iron shipbuilding, the firm built many noted screw-steamers for the P. and O., and other lines, but more especially the Inman, for whom they built almost all the steamers, including the first **City of Paris, City of Brussels,** and the handsome **City of Richmond**, the latter being the last; and it is remarkable that as their shops were constructed to build the horizontal trunk engines which the line favoured, it was necessary, owing to want of height, to build the vertical engine for this vessel horizontally in their erecting-shop.

After twenty-five years of successful working, Mr. Tod died at his residence at Partick, Glasgow, on the 24th January, 1859.

Other prominent names now known on the Atlantic Ferry are those of Mr. Walter Glynn of Liverpool, the Chairman of the Leyland Line, and Manager in Great Britain of the Chesapeake Line; Mr. Alfred L. Jones of Liverpool, the leading light of the Bristol services of the Dominion Line to Boston and Canada, also of the extensive services of Elder, Dempster and Co.; and Mr. Baker of America, the moving spirit in the Atlantic Transport Line of London; also Mr. Henry Wilding, the Southampton Manager of the American Line.

Of the superintending engineers who are responsible for the machinery of these great vessels, it is interesting to note that the first gentleman to occupy this important post in any of the regular lines was Mr. Robert Thomson, who was engineer to the Cunard Line under the *régime* of Messrs. D. and C. MacIver from the commencement,

until his death in October 1871. Mr. Thomson was born at Partick, Glasgow, in 1811, and served his apprenticeship with a firm of millwrights and engineers named Graham, Wellington and Co. Afterwards he commenced his sea service on one of the early steamers, named the **Commodore**, trading between Glasgow and Liverpool, from which he joined the Cunard Line. On his death, in 1871, he was succeeded by his assistant, Mr. Logan, who occupied the position until his death in 1885. Mr. Logan was succeeded by the present superintendent engineer, Mr. James Bain, who was appointed to the post from Lloyd's Registry, in which service he was engaged as engineer surveyor. His earlier training was received at Glasgow, where he was apprenticed to R. Napier and Co., from whence he joined the Cunard Company as sea-going engineer. Afterwards, in 1872, he joined the White Star Line, then bringing forward its new style of boats, in which he sailed as chief engineer until appointed to Lloyd's in 1875.

The former well-known superintendent engineer of the Allan Line, Mr. William Wallace, is a native of Greenock, where he received his training in the shops of the Caledonian Railway and Messrs. Caird. On completion of his apprenticeship he entered the shops of Tulloch and Denny of Dumbarton, and afterwards came to Liverpool to look after the engine department of the line some years after its commencement.

The other great line, the White Star, has its engineering department under the superintendence of Mr. S.

Gordon Horsburgh, who has occupied the post almost since its creation. He is a native of Dundee, and was apprenticed in the engineering works of J. and G. Thomson of Clydebank, Glasgow, after leaving which he served as sea-going engineer in the service of Messrs. Bibby of Liverpool, and was from that line appointed to his present position in 1871. Since joining this service he has been most successful in helping to sustain the splendid reputation of the line, and by so discharging his onerous duties as to deserve the confidence and esteem of every one coming in contact with him.

Another of the superintending engineers who have been distinguished on the Atlantic Ferry is Mr. William Glover, who served his apprenticeship in a millwright firm in Dumfries-shire, and in 1844 entered Bury, Curtis and Kennedy's then well known engineering establishment in Liverpool, where he was employed on the building of the machinery of several noted vessels of the period, amongst them being the **Sarah Sands.** When this vessel was ready, he served in her as sea-going engineer for a period of seven years, and afterwards took charge of a noted paddle-steamer named the **Pacific**, which traded for a time between Sydney and Melbourne, and was later put on the line trading from Galway to Halifax and Boston. When on this trade, in 1858, he was appointed to superintend the construction of the machinery of the vessels building at Jarrow and Hull for the Galway Line, and remained as superintendent engineer of that line until it was abandoned.

In 1866 he commenced his present private practice as consulting engineer in Liverpool, and since then has designed and superintended the working of many fine steamers for such well-known firms as Overend and Guerney, Bates, Flinn, Main and Montgomery, and others.

CHAPTER XIII.

EARLIER EVENTS.

BEFORE turning to a general review of the various interesting incidents of the great Atlantic trade during the last sixty years, it will be interesting to give one of the earliest newspaper notices of steamboats, which was published in the *Agricultural Magazine* for November 1803, and is now in the author's possession.

"*An Account of Mr. Symington's New Steam-Boat.*—Several attempts have been made to apply the force of steam to the purpose of propelling boats in canals, and there seems to be no reason to think the undertaking by any means liable to insuperable difficulties. Mr. Symington appears already to have had considerable success, and the method that he has employed for making a connection between the piston and the water-wheel is attended with many advantages.

"By placing the cylinder nearly in a horizontal position, he avoids the introduction of a beam, which has always been a troublesome and expensive part of the common steam-engines; the piston is supported in its position by friction-wheels, and communicates by means of a joint with a crank, connected with a wheel, which gives the water-wheel, by means of its teeth, a motion somewhat slower than its own; the water-wheel serving also as a fly. The steam-engine differs but little with respect to the condensation of the steam, from those of Boulton and

Watt now in general use: there is an apparatus for opening and shutting the cocks at pleasure, in order to reverse the motion of the boat whenever it may be necessary. The water-wheel is situated in a cavity near the stern, and in the middle of the breadth of the boat, so that it becomes necessary to have two rudders, one on each side, connected together by rods, which are moved by a winch near the head of the boat, so that the person who attends the engine may also steer. It has been found most advantageous to have a very small number of float-boards in the water-wheel.

"Another material part of the invention consists in the arrangement of stampers, at the head of the boat, for the purpose of breaking the ice on canals, an operation which is often attended with great labour and expense. These stampers are raised in succession by means of levers, of which the ends are depressed by the pins of wheels, turned by an axis communicating with the water-wheel.

"Mr. Symington calculates that a boat capable of doing the work of twelve horses may be built for eight or nine hundred pounds. An engine of the kind has been actually constructed at the expense of the proprietors of the Forth and Clyde Navigation, and under the patronage of the Governor, Lord Dundas: it was tried in December (1801), and it drew three vessels, of from 60 to 70 tons burden, at the usual rate of two miles and a half an hour. Mr. Symington is at present (July 1802) employed in attempting still further improvements, and when he has completed his invention it may, perhaps, ultimately become productive of very extensive utility.

"W.

"*October* 18, 1803."

This is interesting as being one of the first notices of steam-boats.

In former days, owing to the want of telegraphic communication, great interest was aroused in any overdue

steamer when the delay extended into days, not as at present, when a few hours behind time causes wonderment. This was exemplified in the case of one of the old Collins Line steamers, the **Atlantic**, which did not arrive in New York to time. The suspense there became very great, and it was not for some weeks that the news was brought by the Cunard Liner **Africa**, that the **Atlantic** had experienced a similar accident (the breaking of the shaft) to that which the Cunard **Niagara** had met with a year previously. The sensation which the joyful announcement of the vessel's safety created was immense, for as soon as the guns announcing the arrival of the **Africa** were heard, people rushed to the Battery (the first spot from which communication with the vessel could in those days be obtained), also to the wharfs of the line, eagerly inquiring if the **Atlantic** had been heard of. "What can it mean, what is the object of this uncommon firing?" was the inquiry on every side, and the response was, "The **Atlantic** is safe; she has put into Cork with a broken shaft."

The excitement which the account of the safety of the **Atlantic** created in New York, and especially in the lower part of the city, was so great, that when the guns of the **Africa** were heard, numbers living on the north side of the city hurried to the docks in the neighbourhood of the North River, and eagerly sought for any information concerning this favourite vessel. From the wharf the excitement was carried to all parts of the city. "The **Atlantic** is safe" was announced from the stages of the different theatres. The performances were temporarily suspended

in those places of amusement by the cheering which ensued: and out of doors the welcome intelligence was passed from person to person, that "the **Atlantic** is safe," until every one in the city was acquainted with the gratifying intelligence. It is within the limits of truth and fact, when it is said that every man, woman, and child in New York went to bed that night with a "thank God" on their lips that the **Atlantic** was safe.

Although steamers had been in vogue for nearly twenty years previous to the year 1851, it was not until that year that any official notice was given to the want of reliable safety-valves on the boilers, consequently from time to time serious boiler explosions took place.

In that year, however, after a large number of accidents, Parliament enacted a law reading—

"*After March* 21st, 1852, *it shall not be lawful for any steam-boat of which surveys are required to go to sea, or to steam upon the rivers of the United Kingdom, without having a safety-valve upon each boiler free from the care of the engineer, and out of his control and interference, and such safety-valve shall be deemed to be a necessary part of the machinery upon the sufficiency of which a surveyor is to report.*"

The effect of this regulation was to bring about a marked decrease in boiler explosions on board British ships, but it was not for some years that any action was taken by the United States authorities, and hence many terrible explosions occurred, especially on the competing steamers on the great rivers of America.

One year later, in 1852, another important factor con-

ducing to the greater safety of all moving vessels was enacted by the British authorities, in the shape of an order for carrying of lights at night, the nature of which was distinctly laid down. This consisted in carrying the now well-known white mast-head light, and the red and green lights for each side, the former (red) being for the port or left side of the vessel, and the latter (green) being for the starboard or right-hand side of the vessel, when looking forward. This system had been used some time previously by the City of Dublin Steam-packet Company, whose superintending engineer had devised it, and it has been adopted by all nations; and although collisions have unfortunately not ceased to occur, it can be safely stated that were it not for those lights, it would be almost impossible now-a-days to carry on the great ocean shipping trade as it is.

About the time these lights were being gradually brought into use, an amusing event is reported to have taken place on the Clyde on board one of the tug-boats in use there. This little craft had been some time away trading about the Western Highlands, and when returning home the captain was carefully picking his way up the river in the dark, when suddenly he saw before him the red and green lights of an approaching vessel, and he at once called out to the engine-driver, "Back her, stop her, Jock, we are into the 'pothecaries' shop at Gourock."

Another useful but apparently trifling means of avoiding collisions, was introduced on steamers after the loss of the Collins Liner **Arctic**, in the shape of the now well-known fog-horn or steam-whistle. The adoption of this valuable adjunct was brought about by extensive corre-

spondence in the papers of the day, and it is remarkable that this useful contrivance was never patented, but was made by a rural mechanic in 1832, named Adrian Stephens, working at Dowlais, South Wales, to give the alarm when the water fell short in the boilers.

This contrivance was seen by a sharp workman belonging to Manchester, who was erecting shafting in the Dowlais Mills, and on his return home he brought it before the superintendent of the Liverpool and Manchester Railway, who at once fitted it to all his locomotives.

Looking back from this distance of time, it scarcely seems possible that up to the year 1852 iron as a constructive material for vessels was practically tabooed by the British Admiralty, and the disputed question of which was better, wood or iron, was often raised. In that year, however, the Admiralty prohibition of the use of iron for mail contract steamers was practically abandoned.

Almost before the contest about wood or iron for shipbuilding was decided, another important one presented itself as to whether the paddle- or screw-steamer was the better, for in those days, 1851 and 1852, the screw-propeller for ocean-going craft was only just beginning to be used. This arose, no doubt, through the satisfactory performances of the veteran **Great Britain**, and also through the coming of the Inman iron screws, as they were then called. The passages across the Atlantic Ocean of both these vessels and the wooden Cunard paddle-wheelers were keenly watched and discussed, and in April 1852 a favourable opportunity for comparison offered itself.

The Inman **City of Manchester**, having left Liverpool

twelve hours before the Cunard **Niagara**, delivered her letters in Philadelphia on the same day as the **Niagara's** mails, which were sent from Boston by railway. On the homeward passage, the **City of Manchester** brought three days' later Philadelphia newspapers and letters than the **Niagara**, and entered the Mersey exactly three days after her. The passages, both outwards and homewards, were, as nearly as possible, at the same rate of speed; if anything, in favour of the **City of Manchester**. The **City of Manchester** had 1100 tons of cargo, weight and measurement, on board on her arrival at Philadelphia; and had 1200 tons weight of cargo on board on her arrival at Liverpool, the **Niagara** coming home in ballast. According to Government returns, the **Niagara** was a paddle-steamer of 1850 tons builder's measurement, 1008 tons register, and 750 horse-power. The **City of Manchester** was a screw-steamer of 2125 tons builder's measurement, 1309 tons register, and 350 horse-power. As an instance of the passage of the two classes of steamers, the following tables are examples:—

PADDLE-WHEEL *versus* SCREW STEAMERS.

As even sailing ships, under favourable circumstances, may, once in a time, equal the speed of the best ocean steamers, so is it quite possible for any large-sized screw, of even small engine-power, to do almost as much once in the twelve months; but "an opportunity for comparison has offered on other voyages (besides the one noted above) between screw- and paddle-steamers, both to the eastward and westward," as the following statement of the passages of the Cunard steamers and the Liverpool and Philadelphia *screws* very plainly illustrates:—

PASSAGES TO THE WESTWARD.

Vessel's Name.	For	Date of Sailing.	Date of Arrival.	Passage about. D.	H.
City of Glasgow . . .	Philadelphia.	1850. Dec. 11	1851. Jan. 2	22	0
Africa	New York .	Dec. 7	1850. Dec. 22	14	17
City of Glasgow . . .	Philadelphia.	1851. Feb. 12	1851. Mar. 3	18	18
Europa	Boston. . .	Feb. 15	Feb. 28	13	0
City of Glasgow . . .	Philadelphia.	April 16	May 4	18	0
Asia	New York .	April 12	April 23	10	22
City of Glasgow . . .	Philadelphia.	June 18	July 7	19	0
Africa	New York .	June 21	July 2	11	3
City of Manchester . .	Philadelphia.	July 26	Aug. 13	18	6
Europa	Boston. . .	July 26	Aug. 5	10	12
City of Glasgow . . .	Philadelphia.	Aug. 13	Aug. 30	17	6
Asia	New York .	Aug. 16	Aug. 28	12	9
City of Manchester . .	Philadelphia.	Sept. 17	Oct. 3	16	6
Africa	New York .	Sept. 13	Sept. 24	10	23
City of Glasgow . . .	Philadelphia.	Oct. 8	Oct. 28	20	3
Niagara	New York .	Oct. 11	Oct. 25	14	0
City of Manchester . .	Philadelphia.	Nov. 5	Nov. 20	15	6
Africa	New York .	Nov. 8	Nov. 19	11	8
City of Pittsburgh . .	Philadelphia.	Nov. 29	1852. Jan. 11	43	0
Niagara	Boston . .	Nov. 29	1851. Dec. 13	13	16
City of Glasgow . . .	Philadelphia.	Dec. 10	1852. Jan. 1	22	0
Europa	New York .	Dec. 6	1851. Dec. 23	16	23
City of Manchester . .	Philadelphia.	Dec. 31	1852. Feb. 9	40	0
Asia	New York .	1852. Jan. 3	Jan. 16	13	12
City of Glasgow . . .	Philadelphia.	Feb. 4	Feb. 24	20	10
Canada	New York .	Jan. 31	Feb. 18	17	21
City of Manchester . .	Philadelphia.	Mar. 5	Mar. 20	15	1
Asia	New York .	Feb. 28	Mar. 12	12	23

PASSAGES FROM THE WESTWARD.

Vessel's Name.	From	Date of Sailing.	Date of Arrival.	Passage about.
		1851.	1851.	D. H.
City of Glasgow . . .	Philadelphia.	Jan. 16	Jan. 30	13 16
Niagara	Boston. . .	Jan. 15	Jan. 27	12 0
City of Glasgow . . .	Philadelphia.	Mar. 15	Mar. 31	15 12
Europa.	Boston. . .	Mar. 12	Mar. 23	11 0
City of Glasgow . . .	Philadelphia.	May 15	May 31	15 18
Niagara	Boston. . .	May 14	May 25	10 12
City of Glasgow . . .	Philadelphia.	July 17	Aug. 1	14 18
Africa	New York .	July 16	July 26	10 5
City of Manchester . .	Philadelphia.	Aug. 28	Sept. 14	17 6
Africa	New York .	Aug. 27	Sept. 6	10 6
City of Glasgow . . .	Philadelphia.	Sept. 11	Oct. 1	20 0
Asia.	New York .	Sept. 10	Sept. 21	10 19
City of Manchester . .	Philadelphia.	Oct. 9	Oct. 23	14 3
Africa	New York .	Oct. 8	Oct. 19	10 9
City of Pittsburgh . .	Philadelphia.	Oct. 27	Nov. 16	19 12
America	Boston. . .	Oct. 29	Nov. 9	11 5
City of Glasgow . . .	Philadelphia.	Nov. 6	Nov. 23	17 1
Niagara	New York .	Nov. 5	Nov. 18	12 12
City of Manchester . .	Philadelphia.	Dec. 3	Dec. 20	16 6
Africa	New York .	Dec. 3	Dec. 14	11 2
		1852.	1852.	
City of Glasgow . . .	Philadelphia.	Jan. 8	Jan. 23	15 0
Canada.	Boston. . .	Jan. 7	Jan. 18	10 16
City of Manchester . .	Philadelphia.	Feb. 24	Mar. 12	17 0
Canada.	New York .	Feb. 25	Mar. 8	11 17
City of Glasgow . . .	Philadelphia.	Mar. 4	Mar. 23	18 18
Cambria	Boston. . .	Mar. 3	Mar. 16	12 17
City of Manchester . .	Philadelphia.	April 1	April 16	15 6
Niagara	Boston. . .	Mar. 31	April 13	13 4

In the early period of Atlantic steam navigation some sad and memorable catastrophes took place, which have left terrible records of the havoc and destruction caused by the two great dangers of the deep, namely collision and fire, the latter of which has, in these days of steel, been almost done away with, except on cargo vessels.

Of the former danger the most terrible example in the days of the wooden steamers was the sinking of the Collins Liner **Arctic**, in September 1854, already briefly alluded to, which is graphically described by the Commander in the following letter to the unfortunate owner, E. K. Collins:—

"DEAR SIR,

"It has become my most painful duty to inform you of the loss of the steamship **Arctic** under my command. With many valuable lives, I fear among whom must be included your own wife, daughter, and son, with whom I took a last leave the moment the ship was going down, without myself expecting to see the light of another day to give you an account of the heartrending scene. The **Arctic** sailed from Liverpool, Wednesday, Sept. 20, at 11 a.m., with 233 passengers and about 150 in the crew. Nothing of special note occurred during the passage, until Wednesday, 27th, when at noon we were on the Banks, in lat. 46° 45′, and long. 25° 00′ W., steering west per compass. The weather had been foggy during the day, and generally a distance of half to three-quarters of a mile could be seen, but at intervals of a few minutes a very dense fog followed, by being sufficiently clear to see

one or two miles. At noon I left the deck for the purpose of working out the position of the ship. In about fifteen minutes I heard a cry of *hard* starboard from the officer of the deck. I rushed on deck and had just got out when I heard a crash forward. At the same moment saw a steamer under the starboard bow, and the next moment she struck against our guards and passed astern of us. The bows of the strange vessel seemed to be literally cut or crushed off for about ten feet, and seeing that she must instantly sink in a few minutes, and taking a hasty glance of our own ship, and believing we were comparatively uninjured, my first impulse was to endeavour to save the lives of those on board the sinking vessel. The boats were cleared, and the first officer and six men left with one boat, when it was found our own ship was leaking fearfully. The engines were set to work, bilge injections put on, steam-pumps and the four deck-pumps worked by passengers and crew, and the ship headed for land, which I judged to be about fifty miles distant. Being compelled to leave my boat with the first officer and crew to take care of themselves, several ineffectual attempts were made to check the leak by getting sails over the bow; and, finding the leak gaining on us very fast, notwithstanding all our powerful means of keeping her free, I resolved to get the boats ready, and as many ladies and children placed in them as possible, but, no sooner had the attempt been made, than the firemen and others rushed into them in spite of all opposition. Seeing this state of things I ordered the boats to be veered astern by ropes to be kept in readiness until order

could be somewhat restored, when, to my dismay, I saw them cut the rope in the boat, and soon disappear astern in the fog. Another boat was broken down by persons rushing into her while hanging at the davits, and many were precipitated into the sea and drowned. This occurred while I had been engaged in getting the starboard guard-boat ready, and placed the second officer in charge of her, when the same fearful scene as with the first boat was being enacted, men leaping from the top of the rail down twenty feet, crushing and maiming those who were in the boat. I then gave orders to the second officer to let go and row after the ship, keeping under or near the stern to be ready to take on board women and children as soon as the fires were out and the engines stopped. My attention was then directed to the other quarter-boat, which I found broken down, but hanging by one tackle; a rush was made for her also, and some dozen or fifteen got in and cut the tackle, and were soon out of sight. In the meantime I found that not a seaman was left on board, or carpenter, and without any tools to assist in building a raft, as our only hope, and the only officer left was Mr. Doran, the third officer, who aided me with the assistance of many of the passengers, who deserve great praise for their coolness and energy in doing all in their power up to the very last moment before the ship sank from under us. The chief-engineer, with a part of his assistants, had taken our smallest deck-boat, and before the ship went down pulled away, with about fifteen persons. We had succeeded in getting the fore- and main-yards, main-topsail, and two topgallant yards overboard, and such other small spars

and materials as we could collect, when I was fully convinced that the ship must go down in a very short time, and not a moment was to be lost in getting the spars lashed together to form a raft. To do this it became necessary to get the lifeboat, 'our only remaining boat,' into the water. This being accomplished, I gave Mr. Doran charge of the boat, taking care to keep the oars on board, to prevent them from leaving the ship, hoping still to get the most of the women and children in this boat at last. They had made considerable progress in securing the spars together, when an alarm was given that the ship was sinking; and the boat shoved off without oars or anything to help themselves with, and when the ship sunk the boat had got clear, probably an eighth of a mile to leeward. In an instant, about a quarter to five p.m., the ship went down, carrying every soul on board with her. I soon found myself on the surface, after a brief struggling with my own helpless child in my arms, when I again found myself impelled downwards to a great depth, and before I reached the surface a second time, had nearly perished and lost the hold of my child. As I struggled to the surface of the water, a most awful and heartrending scene presented itself to my view; over two hundred men, women, and children struggling together amidst pieces of wreck of every kind, calling on each other for help, and imploring Almighty God to help them. Such an appalling scene may God preserve me from witnessing again. I was in the act of trying to save my child when a portion of the paddle-box came rushing up edgewise, just grazing my head, and falling its whole

weight upon the head of my darling child. In another moment I beheld him lying lifeless in the water. I succeeded in getting on to the top of the paddle-box, in company with eleven others. One, however, soon left for another piece of the wreck, finding that it could not support so many. Others remained till they were one by one released by death. We stood in water at a temperature of 45° up to our knees, and frequently the sea broke entirely over us. We soon seemed to separate from our friends on other parts of the wreck, and passed the dreary night, each one of us expecting every hour would be our last. At last the wished-for morning came, dreary and cold, with a dense fog, not a living soul to be seen but our own party, seven being now left. In the course of the morning we saw some water-casks and other things belonging to our ship, but nothing that we could get could afford us any relief. Our raft was steadily settling, as it absorbed more and more water. About noon, Mr. S. M. Woodruff, of New York, was relieved by death. All the others now began to suffer very severely for the want of water, except Mr. George F. A. Allen and myself. In that respect we were very much favoured, although we had not a drop on the raft. The day continued foggy, except just at noon, 'as near as we could judge.' We had a clear horizon for about half-an-hour, and nothing could be seen but water and sky. Night came on thick and dreary, with our minds made up that neither of us would live to see the light of another day, and very soon three more of our suffering party were relieved by death, leaving Mr. Allen, a young German, and myself. Feeling myself

getting exhausted, I now sat down for the first time, about eight o'clock in the evening, on a trunk which providentially had been found on the wreck. In this way I slept a little through the night, and became somewhat refreshed. About an hour before daylight, now Friday, 29th, we saw a vessel's light near to us, and we all three of us exerted ourselves to the utmost of our strength in hailing, until we became quite exhausted. In about a quarter of an hour the light disappeared to the east of us. Soon after daylight a barque hove in sight, to the N.W. of us, the fog now having lifted a little, steering apparently for us, but in a short time she seemed to have changed her course, and again we were doomed to disappointment. Yet I feel in hopes that some of our fellow-sufferers may have been seen and rescued by them. Shortly after we had given up all hopes of being rescued by the barque, a ship was discovered to the east of us, steering directly for us. We now watched with the most intense anxiety as she approached us, with the wind varying, causing her to change her course several points. About noon they fortunately discovered a man on a raft near them, and succeeded in saving him, by the second mate jumping over the side, and making a rope fast around him, by which he was got on board safely. This man proved to be a Frenchman, who was a passenger on board the steamer with which we came in collision. He immediately informed the captain that others were on pieces of the wreck, and by going aloft he saw us and three others. We were the first to which the boat was sent, and safely taken on board about three p.m. The next was Mr.

James Smith, of Mississippi, second-class passenger. The others saved were five of our firemen. The ship proved to be the **Cambria**, of and from Glasgow, bound to Montreal, Capt. John Russell, who commanded the barque **Jesse Stevens**, and was rescued at sea by Captain Nye, of the **Pacific.** Of Captain Russell it would be scarce possible to say enough in his praise for the kind treatment we every one of us have received from him during the time we have been on board his ship. His own comforts he has given up in every respect for our relief. The Rev. Mr. Walker and lady, and Mr. Sutherland, who were passengers on board the **Cambria**, have been unceasing in their endeavours to promote our comfort. To them and to all on board we shall ever owe a debt of gratitude for their unbounded kindness to us while on board the **Cambria.** From the Frenchman who was first picked up, we learned that the steamer with which we came in collision was the iron screw-steamer **Vesta**, from St. Pierre, Newfoundland, bound and belonging to Granville, France. As near as I could learn, the **Vesta** was steering E.S.E., crossing our course two points, with all sail set, wind W. by S. Her anchor-stock of iron, about 7 by 4 inches square, was driven through the bows of the **Arctic**, about 18 inches above the water-line, and an immense hole had been made, most likely at the same instant, by the fluke of the anchor 2 feet below the water-line, raking fore and aft the plank, and finally breaking the shank, leaving the stock remaining in and through the side of the **Arctic**; or it is not unlikely that, as so much of her bows had been crushed in, some of the heavy longitudinal pieces of

iron running through the ship may have been driven through our sides, causing the loss of our ship, and, I fear, hundreds of most valuable lives.

"*Saturday morning, seven o'clock, 14th.*—We have safely arrived at Quebec, and I am left without a penny in the world to help myself with, or anything but sincere gratitude to repay those from whom I have received such unbounded kindness since I have been so providentially thrown among them, and with whom I am now about to separate to go to my home of sorrow. I learnt from the doctor, at Quarantine, last evening, that the **Vesta** had reached St. John's with some persons from the **Arctic**, but could not learn the particulars. As soon as I can get on shore shall make arrangements to leave for New York, with the least possible delay, and expect to take the steamer for Montreal this afternoon.

I am, dear Sir, very respectfully, your obedient servant,

"JAMES C. LUCE.

"*Quebec, Oct. 14th,* 1854."

This terrible disaster to the **Arctic** was the last of a series of misfortunes which steam-vessels had been experiencing during the whole of the year 1854, both on the Atlantic and other oceans. After this, the most serious loss of life was caused in 1858, by the burning of the steam-ship **Austria**, of the Hamburg-American Line, which was started by a hot iron dropping into a tar-bucket in one of the steerages, and spread so quickly the engines could not be stopped by the engineers.

As an instance of how double disaster may be experienced

at the same time, the loss of the **Connaught**, of the Galway Line, may be interesting. This paddle-steamer, which was quite new, sailed from Galway in September of 1860, with a large number of passengers and the mails. She touched at St. John's, Newfoundland, on October 3rd, and then proceeded to Boston, but was not long at sea again before a serious leak was discovered which required very extensive hand-pumping to keep down; eventually the water rose so high as to put out the fires in the boilers. Soon after this crisis had been reached, on Sunday, October 7th, smoke was noticed issuing from the after stokehole, and this developed into an extensive fire which attacked the saloon quarters, and soon proved to be much more serious than the leak. Fortunately a small brigantine, named the **Minnie Schiffer**, came in sight, and stood by, and as the flames continued to extend, all the passengers were transferred to the brigantine, and were followed later by the captain and crew, who were eventually forced to abandon her just about sixteen hours after the fire was first discovered. The brigantine, with her large passenger list of 602 human beings, set sail and landed them at Scituate, from whence they found their way to their destinations.

Amongst the earlier events of the Atlantic Ferry was the announcement, in August 1853, of the first meeting of the Eastern Steam Navigation Company, which was held in London. At this meeting it was announced by the chairman (H. T. Hope) that the success of the venture was based upon the fact of their being able to carry goods and passengers without the numerous stoppages which a voyage to India or Australia entailed upon other vessels.

Their theory, right or wrong, was, that until vessels were constructed of a magnitude sufficient to carry a quantity of coals suitable to the length of the voyage, the full advantages which steam navigation was calculated to confer would not be secured to passengers to India or Australia. Their capital was £1,200,000, with power to increase it to £2,000,000, and until one-tenth of the capital, or £120,000, was paid up, they could not enter into any binding contract for the building of vessels or execution of works. The Company, therefore, were not responsible for the works that had been already undertaken; everything had been done at the risk of the contractors. On the last occasion of their meeting it had been suggested that they ought not to commence operations until 40,000 shares had been taken, representing a capital of £800,000. They were a few hundred shares short of that absolute amount, but they had upwards of 39,000 shares taken, and the others would probably be taken up when the parties who had applied for them returned to town. The report was then read. It stated that they had invited tenders from several parties, and had concluded provisional arrangements for the construction of the engines and of the hull of the first ship with Messrs. James Watt and Co., of Soho, and Messrs. Scott Russell and Co., of London. The **Great Eastern** will be built on the Thames, and is to be completed in eighteen months. The dimensions and power of the ships are intended to be as follows, viz.:—Length, 680 feet; breadth, 83 feet; depth, 58 feet, with screw and paddle engines; aggregate nominal horse-power, 2600. They

are to be so constructed as to take their whole amount of coals for the voyage from near the pit's mouth at a rate not exceeding, for the best quality, 12*s.* to 14*s.* per ton. On the voyage of existing steamships to Australia or India and home, the consumption amounts to from 4000 to 6000 tons; the cost of which would supply 15,000 to 20,000 tons if taken on board at some port in immediate communication with the coal-field. The ships will carry, besides their own coals, upwards of 5000 tons' measurement of merchandise, and will have 500 cabins for passengers of the highest class, with ample space for troops and lower-class passengers. These, the directors consider, they will not only be able to carry at rates much smaller than those by any existing steamships, but with an unprecedented amount of room, comfort, and convenience, which the great size of the vessels will enable them to afford. In thus increasing the size of their ships, the directors believe that they are also obtaining the elements of a speed hitherto unknown; and if hereafter coals applicable to the purposes of steam can be supplied from the mines of Australia, the carrying capacity of their ships, both for cargo and passengers, will be proportionately increased. The great length of these ships will undoubtedly, according to all present experience, enable them to pass through the water at a velocity of fifteen knots an hour, with a smaller power in proportion to their tonnage than ordinary vessels require to make ten knots. The hulls of the ships will be of iron, and of more than usual strength, whilst the magnitude of their dimensions will afford peculiar facilities for introducing

many precautionary measures conducive both to strength and security. The whole of the ship's bottom, and up to six feet above the water-line, will be double, and of a cellular construction, so that any external injury will not affect the tightness or the safety of the ship. The upper deck will also be strengthened on the same principle, so that each ship will be a complete beam, similar to the tube of the Britannia Bridge. The vessels will be divided into ten completely separate water-tight compartments; and, as the intermediate spaces are sufficient in such ships, being each sixty feet in length, to afford a convenient arrangement of separate saloons and cabins, the bulkheads can be carried completely to the upper deck, giving an efficiency to the system of compartments which has not yet been attainable; and these compartments admit of further subdivision up to the lower deck, which will be from four to eight feet above water. Separate sets of engines, each with several cylinders and separate boilers, will be applied to work the screw, distinct from those working the paddle-wheels, so that in the event of temporary, or even permanent derangement of any one of the engines, or of either the paddle-wheels or of the screw, the other engines and propellers would still be available, and the only result would be a proportionate diminution of speed and consumption of fuel, thus rendering the chances of any serious delay almost infinitely remote. The ship will become, by its construction, a beam of strength sufficient to meet any strain to which it can be subjected, and will consist of so many distinct compartments that no local injury, however serious, can

affect its buoyancy to any dangerous extent. The result of the directors' calculations (made on the assumption that the carrying capacity for goods outwards should be occupied at the rate of £4 10*s.* per ton, being considerably below present freights, and only one-half of the cabin room occupied, at rates for *first* class passengers, £65; *second* class, £35; and *third* class, £25; including provisions; giving to each of the respective classes enlarged accommodation, and assuming that only one-third of the vessel's capacity would be occupied on the homeward voyage) is that, after making the most ample allowance for working expenses, depreciation, wear and tear, and insurance, a surplus remains equal to forty per cent. per annum upon the capital invested.

As the days of the old famous sailing passenger vessels have now passed away, it is interesting to recall the glowing accounts which were given of any new clipper which made her appearance. In July 1853 a noted craft, named the **Sovereign of the Seas**, arrived in the Mersey from New York after the fastest passage up to then made by any sailing clipper, the average all the way across being 12·73 knots per hour. This famous vessel was built by McKay, of Boston, the builder of the celebrated clipper-ships **Staffordshire**, **Flying Cloud**, **Flying Fish**, etc., and was named after a ship built at Woolwich Dockyard, in the year 1637, the tonnage of which corresponded with the year, and she was the first vessel built with "flushe decks," and the largest, up to that period, belonging to the English navy. Her keel measured 187 feet 9 inches; her main breadth of beam was 48 feet 4 inches, and she had three decks, a

poop, and topgallant forecastle. She was pierced for 126 guns.

The **Sovereign of the Seas** had a dead rise of 20 inches, and concave lines, and the longest and sharpest bows of any ship or ocean steamer afloat. Her dimensions were as follows:—Length between perpendiculars, 258 feet; over all, from the knightheads to the taffrail, 265 feet; extreme breadth of beam, 44 feet, about 20 feet forward of the centre; breadth at the gunwale, 42 feet; depth, 23½ feet, including 8 feet height of between-decks; deck rise, 20 inches; sheer, nearly 4 feet; and registered tonnage 2421 tons. Considering the sharpness of her ends, she had large tonnage capacity for a clipper, great surface and length of floor, and was very buoyant and easy under canvas. She was sheathed with yellow metal up to 20½ feet forward, and to 21½ feet aft. Her bulwarks were 5 feet 2 inches high, surmounted by a monkey rail of 18 inches, and the space between the main and rack rails was filled in with a heavy clamp, bolted both ways. All her accommodations were on deck. She had a full topgallant forecastle, a large house amidships, and a spacious trunk cabin, in two divisions, built into a half-poop deck, with steerage-room abaft. Her construction, for solidity and strength, was of the highest order; her frame was entirely of seasoned white oak, and all her planking and ceiling, as well as her deck-frames and lower deck, were of the best of hard pine, and she was copper-fastened, square bolted, and treenailed through. In her hold all her knees were of oak, and all her hooks throughout; in the between-decks, the knees were all constructed of hackmatack. She was

SOVEREIGN OF THE SEAS.
Wooden Atlantic Clipper Ship, 1853.

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11 feet 8 inches through the backbone, including the moulding of the floor-timbers, which was 19 inches. And all her keel and kelson fastenings were of $1\frac{1}{2}$ copper and iron bolts, driven in the strongest style, and riveted. Her keel was sided 16 inches; and, besides the midship kelsons, she had double sister-kelsons, one over the other, on each side, which combined side 15 inches, and mould 30. She had, moreover, the stoutest and most beautifully proportioned set of spars that ever towered above a ship's deck, which spread about 12,000 yards of canvas. All her lower masts were "made" from the head to the step, each mast in five pieces, bolted and hooped together. Her bowsprit was also a "made" spar, all the outside pieces being of hard pine. Her masts raked, commencing with the fore 3-8ths, 4-8ths, and 1 inch respectively to the foot. Her foremast was 41 inches in diameter, $89\frac{3}{4}$ feet long; topmast, 19 inches diameter, 50 feet long; topgallant-mast, 14 inches diameter, $27\frac{1}{2}$ feet long; royal, $11\frac{1}{2}$ inches diameter, 18 feet long. Mainmast, 44 inches diameter, $92\frac{3}{4}$ feet long; topmast, $19\frac{1}{2}$ inches diameter, 54 feet long; topgallant-mast, $14\frac{3}{4}$ inches diameter, 30 feet long; royal, 12 inches diameter, 20 feet long; and skysail-yard, 10 inches diameter, 14 feet long. Mizzenmast, 34 inches diameter, $82\frac{3}{4}$ feet long; topmast, 16 inches diameter, 43 feet long; topgallant-mast, 11 inches diameter, 24 feet long; and royal, $9\frac{1}{2}$ inches in diameter, and 17 feet long.

In the same year, 1853, the large passenger trade carried on in the sailing vessels became remarkable, owing to the great mortality which was taking place, and attention was drawn to it by the press on both sides of the Atlantic, one

of the most condemnatory articles on the sailing ships stating that "Among the arrivals at New York of emigrant ships during the past few weeks, a very large number of deaths have been reported. In one vessel, the **Charles Sprague**, the unusual large number of forty-five persons died on the passage from Bremen; and in another, the **Winchester**, from Liverpool, the number of fatal cases amounted to no less than seventy-nine. The following was the number of cases at New York, from September 9th up to October 26th, 1853:—

Arrived 1853.	Ships.	Where from.	No. of Passengers.	Deaths.
Sept. 9	**Zurich**	Havre	358	2
,, 11	**Lucy Thompson**	Liverpool	800	35
,, 15	**Niagara**	,,	249	38
,, 21	**Charles Sprague**	Bremen	280	45
,, 26	**Oder**	Hamburg	237	14
,, 27	**Winchester**	Liverpool	463	79
,, 29	**Kate Hunter**	,,	342	1
,, 29	**Rhine**	Havre	566	24
,, 30	**Talleyrand**	Hamburg	210	11
,, 30	**Louisiana**	,,	142	3
Oct. 11	**Harvest Queen**	Havre	367	5
,, 12	**Copernicus**	Hamburg	152	19
,, 14	**Orphan**	Bremen	280	4
,, 14	**Marmion**	Liverpool	295	34
,, 17	**Waterloo**	,,	294	4
,, 17	**James Wright**	,,	430	1
,, 19	**Statira Morse**	Glasgow	201	2
,, 20	**Sir Robert Peel**	London	407	6
,, 20	**Cordelia**	Bremen	339	3
,, 20	**London**	Havre	229	2
,, 21	**New York**	Liverpool	400	16
,, 21	**Benjamin Adams**	,,	620	15
			7661	363

"Although the captains, in their reports, with one exception, merely mentioned the fact of such a number

having died, it is pretty certain that the disease which carried them off was cholera, that fatal malady which made such havoc among the shipping in Europe. Several, no doubt, died by the common diseases, but that cholera was raging on board many of the above-named vessels is beyond all question, from the fact that thirty-three persons who were landed at quarantine were suffering from that epidemic. The sickness on the **Benjamin Adams** was decidedly cholera; and, in addition, the ship **Sagadahock**, from Gottenburg, which arrived at Boston, reports the loss of seventy passengers by the same disease."

CHAPTER XIV.

THE MANNING, EXPENSES, COST, AND RECORD OF ATLANTIC LINERS.

TURNING to the navigating of a liner, the first duty is to express a word of praise to the long list of commanders, engineers, officers, and seamen who have in the past piloted these famous vessels to and fro, and who have been succeeded by those of the present day.

Except by one intimately acquainted with the working and manning of an Express Liner, only a faint idea can be formed of the great change which has taken place relatively in the number of hands required in the various departments; the department now requiring the fewest hands being the sailing, which in former times was of necessity the most extensive.

Now-a-days this department numbers, for a twin-screw liner, exclusive of the commander, about 50; made up of 6 officers, 2 carpenters, 2 boatswains, 6 look-out men (specially examined as to colour blindness), 6 quartermasters, 1 storekeeper, 1 lamp-trimmer, 26 seamen (A. B.'s). These are divided into two watches, port and starboard, consisting of 3 officers, 3 look-outs, 3 quartermasters, 1 boatswain, and 13 seamen.

The staff under the chief engineer numbers 234, as follows:—1 senior second engineer, 1 second, 2 thirds, 2 fourths, 2 assistant-seconds, 2 assistant-thirds, 2 assistant-fourths, 2 fifths, 2 sixths, and 2 sevenths, making 19 engineers altogether; but in addition come 3 boiler-makers, 6 electricians, 3 refrigerating engineers, making no less than 31 highly trained officers; 2 winchmen, 3 storekeepers, 36 greasers, 12 leading firemen, 90 firemen, and 60 trimmers or coal-passers.

This immense staff is arranged in three watches of four hours each, as follows:—6 engineers and 1 boiler-maker with 9 greasers for the propelling machinery, 2 electricians with 2 greasers, 1 refrigerating engineer with 1 greaser, 4 leading firemen, 30 firemen, 20 trimmers, and 1 storekeeper.

In the passenger and victualling departments, a staff averaging, exclusive of the doctor, about 177 men are engaged under the purser and chief steward, and are rated as follows:—1 second steward, 45 saloon, 22 bedroom, 10 pantrymen, 8 "boots," 25 second cabin stewards, 20 steerage stewards, 14 cooks, 6 scullions, 7 bakers, 4 butchers, 8 boys, 1 captain's steward, 2 barbers, and 4 storekeepers. This number, unlike the other departments, is, however, always varying more or less, according to the number of passengers to be carried.

Adding the totals of the three departments together, namely, 51 sailing, 234 engine, and 177 passenger, the large number of 462 hands are required, as a rule, in the running of these vessels; the wages of these per month may be taken at, say, £336 for the sailing, £1350 for the

engine, and £780 for the passengers, making a total of £2466 per month. When these figures are considered, together with the other heavy expenses of up-keep or maintenance, office expenses, insurance, agency commission, shore staff, works, port charges, interest on capital, and depreciation, it may be fairly taken that, at least, the sum of £30,000 is required to be realized per trip before any profit can be counted upon. In addition to these heavy expenses there come the astonishing figures representing the first cost of the fastest and latest liners, which has now reached over £700,000 for each vessel, so that some idea of the enormous sums at stake in the working and management of an express Transatlantic Line can be realized. When these vast figures are considered, together with the very extensive requirements enumerated elsewhere, the chimerical nature of the schemes proposed from time to time for forming new lines, which promise three and four days' passage across the Atlantic, can easily be discerned. They are overwhelming proof that the difficulties to be surmounted are too great for any company or firm, without shipping experience, to suddenly launch forth a new service which would have greater speed and be more luxurious.

With a view of forming a ready idea of the gradual development of the Ferry, it is only necessary to review the tables given in the Appendix; for instance, Table No. 1 shows in a marked way the increasing sizes and power of the typical vessels, advancing from the wooden **Royal William** in 1838, with 1980 displacement tons and 400 indicated horse-power, to the Cunard **Britannia** in

1840, with 2050 displacement tons and 740 horse-power; then the wooden **America** in 1848, with 4250 displacement tons and 1400 horse-power; after which, in 1857, the last wooden paddle **Adriatic** came out with 7960 displacement tons and 4000 horse-power; then the first **City of Paris** in 1866, with 6411 displacement tons and 2600 horse-power; and so on down to the **Oceanic** in 1899, with 26,100 tons displacement and 29,000 indicated horse-power.

The next Tables, Nos. 2 and 3, tell an interesting story of how the duration of the passage on the Atlantic Ferry, both outward and homeward, has been gradually reduced first by days, then by hours, and in later years by minutes. It is in considering this Table that the various performances of the steamers of rival lines when competing with each other come under notice. The first important rivalry is that of the American-built **Washington**, already noted, page 48, when in the year 1847 she sailed from New York at the same time as the Cunarder **Britannia** sailed from Boston.

Following upon this, in 1850, when the Collins Line came on the scene, the rivalry between the Cunard and the new-comer proved very keen. The passages of the Collins **Atlantic** and **Arctic** being as a rule better than their rivals, led to the Cunard Line bringing out the **Asia** and the **Africa** in 1851, then the **Arabia** in 1852, all built of wood; after this, in 1856, they brought out their first iron paddle mail-vessel, the **Persia**, which surpassed all the existing vessels, and regained for the line the coveted honour of having made the fastest passages outward and homeward.

In order to keep the lead by having the **fastest vessel** o the Atlantic, the Collins Line brought out the **Adriatic** t surpass the Cunarder in December 1857, but the collaps of the Company, in 1858, prevented her from breaking th record on the Liverpool-New York route; but later on, whe placed on the Galway Line, she made some fine runnin and attained higher speed than any of the then existin liners.

Following the **Adriatic** came the Cunard Liner **Scoti** in 1862, prompted more by the natural expansion of th passenger and mail service than by competition; this note craft was an improved **Persia**, and made the record passage in 1864, which were not surpassed until 1867.

In November that year (1867) the Inman Line steamer the first **City of Paris**, lowered the outward record passage and another famous vessel, the Cunard **Russia**, now the **Waesland** (see p. 39), also came out, and the performance of these two rivals were eagerly watched by the public the various runs of the vessels being closely criticized by the respective managers, MacIver and Inman. Following them came the Inman Liner **City of Brussels**, in 1869, which made the fastest homeward passage in December of that year, and practically remained the fastest liner on the Atlantic Ferry until 1872, when the White Star **Adriatic**, in May, lowered the outward record.

From the date of the rapid passage of the **City of Paris** in 1867, the Cunard Line practically retired from the contest for the honour of the fastest passage, or, as it has not inaptly been termed, the "*blue ribbon of the Atlantic*," so that the Inman Liners then had it all to themselves.

until the year 1872. In 1871 the White Star Line came upon the scene, and their pioneer, the first **Oceanic**, was confronted by the **City of Brussels**, as was also each succeeding new vessel, namely, the **Atlantic** on June 12th, 1871; the **Baltic** on Sept. 4th, 1871; the **Republic** on Feb. 1st, 1872; but on the coming of the **Adriatic**, April 11th, 1872, this order was changed, as the latter vessel proved more than a match for her, and in January 1873 the **Baltic** made the fastest homeward run.

The effect of this rivalry was the coming of the Inman Liners **City of Chester** in 1873, **City of Richmond** in 1874, and **City of Berlin** in 1875. Soon after her advent the latter vessel won back "the blue ribbon" for the line, by making the fastest outward passage in September, and the homeward in October of the same year. Following after this, in February 1876, the White Star **Germanic** and the same Company's **Britannic** in November of the same year won back the ribbon and retained it until the coming of the Guion Liner **Arizona** in 1879, which made the fastest homeward passage in July of that year, and the fastest outward in May 1880.

In order to again take front rank, the Inman Company in 1881 brought out the beautiful **City of Rome**, but unfortunately for the line, she never came up to the speed of the then competing vessels. In the same year the Cunard **Servia** came out, and in 1882 the **Aurania**, but it was not until the coming of the Guion **Alaska** in 1882 that the **Arizona's** achievements were surpassed, as in that year the newer vessel made the record outward and homeward passages, the latter being the first under seven days.

These were again put in the shade by the coming of the **Oregon** for the same line in 1883, which lowered the outward and homeward records by almost half a day when under the Guion flag.

Following this steamer in 1884 came the only fast liner owned by the National Line, the **America**, which beat the record homeward on her first voyage in June, and, although eclipsed in August of the same year by the Guion **Oregon**, she made excellent running during the short period she was at work on the Atlantic.

A noteworthy feature in connection with the **America** was a coalition formed with the builders of the **City of Rome** as owners and the Orient Line of London, proprietors of the Australian Liner **Austral**, to run a joint service of express passenger vessels between Liverpool and New York with these three vessels.

The **Austral**, which had been sunk in Sydney Harbour, was thoroughly overhauled and put on the Atlantic Ferry with the other two boats, and for one season, in 1885, formed an express passenger service, but this was broken up by the sale of the **America** in 1886, and the return of the **Austral** to the Australian trade. The record only remained with the ill-fated **Oregon** for one year, as it was reduced in May 1885 by the Cunard **Etruria**, and again by the same vessel, which made the record homeward run in March 1887.

From this date the "fastest passage" remained with the Cunard, until the year 1889, when their old rival, reconstituted under the name of the Inman and International Line, wrested it from them once again by their new

twin-screw the (second) **City of Paris**, which had succeeded in reducing both the outward and homeward runs to under six days in September and August respectively.

As if to give further interest to this rivalry, the next improvement of both records was made by the White Star **Teutonic** in August and October of 1891, but it was not long held by them, for in August 1892 the **City of New York** reduced the homeward record by an hour, and the **City of Paris** the outward in October by over five hours.

The next advance in speed was made by the Cunard Line, which had up to this remained content with the very satisfactory achievements of the **Umbria** and **Etruria**, but noting the advantages and excellent performances of the twin-screws, and spurred by prestige, the all-powerful factor, they brought out the **Campania** in 1893, which in that year reduced the homeward record by another hour, in May, followed in October by her sister the **Lucania**, reducing the outward also by two hours.

In September of the following year (1894) the **Lucania** made the fastest run homewards, namely, 5 days 8 hours 38 minutes, and the fastest outward, 5 days, 7 hours, 23 minutes, in October.

With a view of making a comparison, the following account of the doings of the various sailing ship lines in 1840, taken from the *Liverpool Mercury* of June 26th in that year, will be of interest—

Extract from "Liverpool Mercury," June 26th, 1840.

PASSAGES OF SAILING VESSELS

Name of Line.	To England.			To New York.		
	No. of Voyages.	Time on Passage	Fastest Passage.	No. of Voyages.	Time on Passage.	Fastest Passage.
Old Black Ball Line	23	22¼ days	18 days	23	33¾ days	22 days
Dramatic Line[1] .	11	20½ ,,	17 ,,	12	33½ ,,	23 ,,
Star Line	11	24 ,,	21 ,,	11	39 ,,	27 ,,
Swallow-Tail Line .	11	22½ ,,	17 ,,	11	35 ,,	28 ,,

STEAMERS.

Great Western . .		13¾ days	12¼ days		16¼ days	18 days
Liverpool[2]		15¾ ,,	13¾ ,,		17½ ,,	16 ,,

From this it will be seen the best average passages out ward to New York were 33½ days by the Dramatic Lin clippers, the fastest passage being 22 days, made by th old Black Ball Line.

For the homeward trip, the best average passages wer those of the Dramatic Line, being 20½ days, the fastes passage being made by their vessels and also those of th Swallow-Tail Line in 17 days. The time occupied by th only two regular steamers, the **Great Western** and **Liver pool**, is also of interest, as showing the speeds then attained and which may be continued down to the present day b reference to the Tables Nos. 4 and 5, which show the aver age passages made by the various steam lines since 185C

[1] See Life of E. K. Collins, p. 154.

[2] The **Liverpool** had eighteen hours' farther steaming than th **Great Western**.

It will be seen that for the fastest vessels of each line the average passages for the years 1897 and 1898 are as follows—

	Outward.	Homeward.
	d. h. m.	d. h. m.
Cunard **Campania** and **Lucania** .	5 19 27	5 16 26
American **St. Louis** and **St. Paul** .	6 3 42	6 7 35
White Star **Majestic** and **Teutonic**	6 6 2	6 4 47

that is, a regular service approaching six days from Queenstown to Sandy Hook. Taking the distance between these two places as 2800 knots outward, and 2840 homeward, these results indicate a mean average speed of 20 and 18½ knots outward, and 20·8 and 19 knots homeward.

Should, however, the performances of the swiftest vessels on their fastest runs become after a little time the average speed of the day, the regular service will be 5 days, 1 hour, 45 minutes, and the mean average speed 23 knots, but at the present time there are only four Atlantic vessels afloat which are likely or capable of effecting this, and these are the two Cunarders, and the two North German Lloyds.

Up to the present time, the greatest distance run in one day of 24 hours 50 minutes, on a westward run, has been 580 knots, equal to 606 miles, which was performed by the North German **Kaiser Wilhelm der Grosse** in May 1898. This gives a rate of 23·3 knots, or nearly 27 statute miles, per hour, and if maintained all the way across the Atlantic, would mean a passage of five days, that is, leave Queenstown at noon on Sunday, and arrive New York at seven in the morning on the following Friday.

The last Table (No. 6) which remains to be commented upon, contains in brief a record of the various steamships which have succumbed to the perils of the deep and, in some instances, left sad memories of friends and relations swallowed up by the great sea, and in others of deeds of indomitable courage and daring (such as the rescue of every life from off the **Danmark**), greater and more heroic than any which have ever earned the distinction of the Victoria Cross amid the clash of arms, because they have been effected under more thrilling circumstances, and in a higher and nobler cause.

Out of the 158 vessels lost, it will be noticed 76 caused loss of life either directly or indirectly, and it is a matter of great congratulation to notice that not a single life has up to the present been lost by any casualty to the great twin-screw Express Liners, a fact which must be largely attributed to the effective bulkhead division now in vogue, as illustrated by the **City of Paris** breakdown.

Of the other vessels, it will be noticed that 30 were never heard of after leaving port, so that no definite reason can be assigned for their loss; the first to figure under this heading being the unfortunate **President** in 1841.

Of the others, 73 were wrecked, 20 foundered, 10 were burned, 6 sunk by ice, and 19 sunk by collision, which last has so far been the only one in this unfortunate category of maritime dangers to claim as a victim one of the swift ships of the great express tra le.

When considering this extensive Table, it may not be

out of place to draw attention to the fact that although the North Atlantic Ocean is the most frequented by steamers, it is at the same time by far the wildest and most trying of all seas, for in no other portion of the globe is it possible to experience practically every peril to which those who go down to the sea in ships are called upon to encounter.

Sometimes the danger lies in the densest of fogs; following this may come terrific hurricanes of wind with mountainous seas; at rare intervals, a vast tidal wave which in its immensity suddenly rises up before a stately liner, and if not completely overwhelm her, deals widespread destruction about the upper works; following upon this may arise the risks due to floating derelicts, or to huge icebergs drifting hither and thither. Later on snowstorms may sweep down, and accompanied by a weird blizzard so envelop the ship with snow and ice as to render her almost unmanageable.

For an instance of the trying seasons which are sometimes experienced, none more remarkable than that presented by the winter of 1898 and 1899 ever presented itself since the commencement of steamships on the Ferry. Commencing towards the end of November in the former year, terrific storms of wind and rain swept the Lane routes as they are called (see p. 155), and raised such mountainous seas that vessel after vessel became overdue or was reported abandoned.

One of the most remarkable of these was the old Cunard Boston Liner, **Pavonia**, which, on an outward passage, was so tossed about that the boilers became loose

in their seats (but not, as was generally reported, got altogether adrift), and having broken the steam-pipe connections, was totally disabled in Mid Atlantic, and after endeavours to tow her by one vessel and being passed by another who declined to assist, was safely towed into St. Michael's, one of the Azores, in Feb. 1899, after about three weeks' anxious suspense, drifting about in mid-ocean. Another eventful matter, which drew world-wide attention, was the disablement of a North German Lloyd boat, the **Bulgaria**; this huge craft of 11,000 tons, built at Hamburg in 1898, was fitted with twin screws, and on the voyage out became totally disabled through the breakage of the rudder-stock in January. Soon after this event one of the officers and a party of the crew were sent off in an open boat to look for assistance. They were picked up by a passing steamer, and reported that the vessel they had left was altogether unmanageable and likely to founder, which, as there were many passengers on board, caused great uneasiness.

In consequence of the long delay in hearing news of her, re-insurances were effected at 90 to 95 guineas per cent., which is generally looked upon as a sign of the total loss of the vessel. These dismal forebodings were, fortunately, later on, set at rest by the safe arrival of the vessel herself off St. Michael's on February 24th, 1899, and during the stay there repairs were executed, and she returned to Hamburg, where the commander and crew were honoured by the German Emperor, who conferred upon the captain some special order as a mark of his skill and pluck in bringing the vessel and her passengers safe into port.

At the same time other vessels were meeting with similar weather; one, named the **Rossmore**, of the Johnstone Line, was thrown on her beam-ends and abandoned early in February, and no less than eight vessels, not regular traders on the Atlantic Ferry, went to swell the list of "never heard of."

In February of 1899 the White Star **Germanic** met with a peculiar and costly accident. She arrived at New York with her rigging and upper works extensively covered with masses of frozen spray and ice caused by the great blizzard then prevailing. Owing to the intense cold and low temperature this great weight, which was estimated to be close upon 100 tons, did not melt away, and a few days after her arrival, when coaling for the homeward voyage, on February 13th, she suddenly heeled over considerably, and immersed the side coaling ports, which allowed the water to fill into the vessel and sink her.

After being under water for some days, she was refloated and sent to Belfast to have the whole of the damaged interior fittings cleared out and refitted, upon completion of which, in May following, she resumed her station.

It is worth noticing that this well-known vessel had, up to this adventure, never experienced any accident during the twenty-four years which in all weathers she had been going to and fro.

In the same month (February) another noted liner, the North German **Fulda**, came to an untimely end by a remarkable accident which happened to her in Liverpool. In January 1899 she was sold to the Canadian Steamship Company (see p. 75), together with the sister vessel, the

Werra,[1] after which they were sent to Liverpool to undergo inspection, and, on February 2nd, the **Fulda** was placed in one of the Birkenhead dry docks for examination; but just before the water was cleared from the dock, the keel-blocks on which she rested suddenly failed, and caused the vessel, weighing nearly 7000 tons, to drop to the bottom of the dock, a height of nearly three feet, but fortunately she remained in a perfectly upright position.

Upon examining the hull after this accident, it was found to be so extensively damaged, that the intending purchasers would not accept her, so that she was abandoned to the underwriters and sold to be broken up.

[1] The sale of this vessel was not completed and she returned to Bremen.

CHAPTER XV.

ATLANTIC RECORDS AND TABLES.

WITH the view of illustrating in a graphic form the records and doings of the famous typical vessels on the Atlantic Ferry during the past fifty-nine years, the author has designed and worked out the diagram and compiled the various tables at the end of the book. An examination of the diagram is of great interest, as the dimensions and leading particulars of typical vessels for the various periods ranging from 1840 to 1899 are each set out to a scale of 200 feet per inch, so that the relative dimensions and performances of each can be seen at a glance and compared with each other. The lines marked T will be found by reference to the Table to denote the time occupied on the passage, and by measuring off on the vertical scale on the right hand of the sheet, the number and fraction of days required for the passage of any of the vessels is at once found. With this line T should be compared the line S, which denotes knots per hour, as it is interesting to observe that as the time, T, on passage gradually decreases from 14 days 8 hours to 5 days 7 hours, the speed per hour, S, gradually increases from 8½

to 22 knots. The next important point is the relative sizes of the ships, which are plainly set out by the offsets marked D, which denotes the load-line displacements to a scale of 3000 tons to the half-inch, and which may be readily measured by the tenth scale plotted on the left side of the sheet.

The displacement being the factor which denotes the real size of the vessel, it will be seen how vast was the size of the old **Great Eastern**, which was designed some forty-five years ago, for although her length was 5 feet less than the **Oceanic**, yet her displacement, 32,160 tons, exceeded this vessel by nearly 6000 tons.

To trace the gradual rising of the steam-pressure carried in the boilers, it is only necessary to note the line P, which shows the gradual advance from the 12 lbs. of the **Britannia** in 1840, to the 30 lbs. in the **City of Brussels** in 1869, which practically was the range during the period of single-expansion engines. After the **City of Brussels**, a great increase to 60 lbs.—the commencing pressure for the compound or double-expansion engines—is shown on the first **Oceanic**, and again a gradual increase to 110 lbs. on the **Oregon** and **Etruria** in 1883 and 1885.

This is succeeded on the **Teutonic** and second **Oceanic** by the still higher pressures of 180 lbs. and 192 lbs. respectively, which are now generally used since the triple and quadruple engine became standard.

Together with the boiler-pressures, the other important items of indicated horse-power and coal consumption, marked H and C, also show interesting changes and

results, one of the most marked being the relatively heavy consumption required for the horse-power given out by large paddle-wheel steamers. This, it will be seen, is reduced by the introduction of the screw-propeller, and again by the adoption of the compound engine, followed by a still further relative reduction by the triple and quadruple expansion engines.

From a study of this diagram and the Tables at the end of the book, it is interesting to form a brief synopsis of the leading features, as, for instance—

The longest vessel now existing is the **Oceanic.**

The one having greatest displacement is the **Oceanic.**

The greatest displacement yet reached was 32,160 tons on the **Great Eastern.**

The greatest power indicated by paddle-engines, 5000 on the **Great Eastern.**

The greatest power indicated by paddle-engines on a regular Transatlantic Liner, was 4000 on the **Scotia.**

The greatest power indicated by single-screw engines, 14,500 on **Etruria.**

The greatest power indicated by twin-screw engines, 32,000 on **Kaiser Wilhelm der Grosse.**

The highest consumption per day paddle-boat, 160 tons on **Scotia.**

The highest consumption per day screw-boat, 500 tons on **Kaiser Wilhelm der Grosse.**

The highest average speed by paddle-boat, 14 knots on **Scotia.**

The highest average speed by screw-boat, 22·86 knots on **Kaiser Wilhelm der Grosse.**

The lowest steam-pressure carried in boilers, 14 lbs. on **Britannia.**

The highest steam-pressure carried in boilers, 225 lbs. on **Kaiser Friedrich.**

The fastest outward passage, Queenstown to Sandy Hook (New York), 5 days, 7 hours, 23 minutes, by the **Lucania** in October 1894.

The fastest homeward passage, Sandy Hook to Roches Point (Queenstown), 5 days, 8 hours, 38 minutes in September 1894.

Although these are the actual fastest passages made on this route, they have been surpassed by the **Kaiser Wilhelm der Grosse** on the Southampton route, this boat having maintained an average speed of 22·8 knots all the way on an outward run, and 22·5 on a homeward, which would mean a passage from Queenstown to New York of 5 days, 2 hours, 35 minutes, and from New York to Queenstown a passage of 5 days, 4 hours, 21 minutes.

Looking back on the various dimensions and particulars of the high-speed vessels just recorded, it cannot be gainsaid but that they reveal startling figures, which it is worth while briefly recapitulating. The German **Kaiser Wilhelm der Grosse** has a grate area of 2500 square feet, which corresponds to a daily consumption of over 500 tons, and 32,000 indicated horse-power, giving an average sea speed of 22·8 knots, or about a half-knot per hour short of the speed required to ensure regular five-day passages between Queenstown and New York.

Referring back to the preceding vessels it will be seen

that the **Umbria** to obtain 19 knots consumed 10·1 tons per hour.

The **Teutonic** to obtain 20 knots consumed 12 tons per hour.

The **Campania** to obtain 22 knots consumed 20·5 tons per hour.

The **Kaiser Wilhelm der Grosse** to obtain 22·5 knots consumed 22 tons per hour.

Whereas the **Five-Day Boat** to obtain 23½ knots will consume 26 tons per hour.

To realize what a consumption of 26 tons per hour means, or say 620 tons per day, it is only necessary to note that if 1·4 lbs. of coal be allowed per indicated horse-power, machinery capable of indicating over 42,000 horse-power must be provided, which means over 9000 tons of weight to be carried, exclusive of 4000 tons of coal, so that the hull must be increased in size considerably to allow for this and the necessary carrying space required.

Up to the present no vessel likely to approach these figures is proposed, the **Oceanic** not being designed for greater speed than the Cunard boats, and the power reported to be fitted in the coming Hamburg-American craft renders it scarcely likely that she will maintain even 23 knots all the way across, although she is likely to be the fastest vessel afloat if the designers' expectations be realized.

Looking at this important question of high speed, it is to be regretted that the British Lines can no longer see their way to build the fastest ocean-going crafts afloat, but the vanishing point of financial success being reached

in the enormous first cost and expensive up-keep, it is not to be expected that private enterprise will equip and maintain them.

Considering the enormous requirements of these great vessels, and also the all-important fact that they have passed from the simple duties of plying to and fro on the Atlantic Ferry to the more important position of being an arm of the Royal Navy, it is evident that the time has now arrived, when direct financial support should be given by the State, for there is no question but that the very existence of these vessels is in itself a means of keeping down the cost of the Navy at large.

That this cost is great shows clearly that the supremacy of the seas must be maintained by the Union Jack, and clearly points out that if in the near future other nations encourage their lines to send forth still faster vessels, Great Britain must then insist and assist their lines to advance again.

In conclusion, it only remains to be said that as in the past, so it will be in the future, be the demands what they may on the owners, shipbuilders, and engineers when the time comes; if only the financial support be given freely, they will outstrip all their previous doings, and send forth all-powerful crafts, which will ensure the same brilliant success as in the past, whether in peace or war, and no doubt render still more interesting the future narrative of the Atlantic Ferry.

TABLES

TABLE No. 1.—DIMENSIONS, ETC., OF FAMOUS ATLANTIC STEAMERS.

Name of Ship.	Owners.	Where built.	Year.	Ship's Dimensions. Length. Over.	Length. B.P.	Breadth.	Depth.	Tonnage.	Displacement.	Engine Dimensions. Cylinders. Num. Dia.	Stroke. ft.	Stroke. in.	Pressure.	Indicated power.	Speed per hour.	No. of boilers.	Furnaces.	Type of engine.	How propelled.	Remarks.
						ft.	ft.		tons				lbs.							
Savannah	Colonel Stevens	New York	1819	145	130	26	16·5	320	1,850	1 of 40	5	0	10	90	6	–	–	Inclined direct-acting	Paddles	Wrecked, 1822.
Royal William	C. of Dublin Co.	Liverpool	1838	175	145	27	17·5	720	1,980	2 of 48½	5	6	5	400	7½	2	8	Side-lever	”	Broken up, 1888.
Sirius	Brit. and Amer. Steam Navig. Co.	Leith	1838	200	178	25·5	18·25	703	1,995	2 of 60	6	0	15	600	8½	2	8	”	”	Wrecked, 1847.
Great Western	G. W. S. S. Co.	Bristol	1838	236	212	35·3	23·25	1,340	2,300	2 of 73½	7	0	15	750	8½	4	12	”	”	Broken up, 1856.
British Queen	Brit. and Amer. Steam Navig. Co.	London	1839	295	275	37·5	27	1,863	2,970	2 of 71½	7	0	15	700	8	4	12	Side-lever	Paddles	Sold foreign, 1841.
Britannia	Cunard	Greenock	1840	230	207	34·5	22·5	1,150	2,050	2 of 72½	6	10	12	740	8½	4	12	”	”	Sold, 1849.
Great Britain	Great Western	Bristol	1843	324	274	48·2	31·5	3,270	5,780	4 of 88	6	0	25	1,500	11	6	24	Chain-gearing	Screw	Hulk, 1890.
America	Cunard	Greenock	1848	270	251	38	25·3	1,825	4,250	2 of 88¾	8	0	13	1,400	10½	4	16	Side-lever	Paddles	Sold, 1863.
Asia	Cunard	Greenock	1850	290	268	45	24	2,227	3,620	2 of 96	10	0	15	2,000	12	4	24	Side-lever	Paddles	Sold, 1867.
Arctic	Collins	New York	1850	300	282	45	31·5	2,860	6,200	2 of 96	10	0	17	2,000	12½	4	32	”	”	Sunk, 1856.
Persia	Cunard	Glasgow	1856	390	360	45	29·9	3,300	7,130	2 of 100½	10	0	20	3,600	12¾	8	40	”	”	Sold, 1868.
Adriatic	Collins	New York	1857	380	355	50	35	3,670	7,564	2 of 104	12	0	25	4,000	13½	6	48	Oscill. cylinder	”	Hulk, 1866.
Great Eastern	G. E. S. S. Co.	Millwall	1858	691	680	82·8	48·2	18,915	32,160	4 of 74 4 of 84	14 4	6 0	30 25	5,000 6,000	– 13	4 6	40 60	Oscillating Horiz. D. A.	Paddles Screw	Broken up, 1891.
Scotia	Cunard	Glasgow	1862	400	379	47·8	30·5	3,871	7,600	2 of 100	12	0	25	4,000	13½	8	40	Side-lever	Paddles	Sold, 1875.
City of Paris	Inman	Do.	1866	359	346	40·4	26·2	2,651	6,411	2 of 89	3	6	30	2,600	13½	8	24	Horiz. trunk direct-acting	Screw	Sold, 1883.
Russia	Cunard	Do.	1867	380	358	43	28·8	2,959	6,770	2 of 87	3	9	25	2,500	13½	4	28	Inverted D. A.	”	Sold, 1881.
City of Brussels	Inman	Glasgow	1869	415	390	40·3	27·1	3,081	6,900	2 of 90	4	6	30	3,000	14½	8	24	Horizon. Trunk	Screw	Sunk, 1888.
Oceanic	White Star	Belfast	1871	432	420	41	31	3,707	7,240	2 of 41 2 of 78	5	0	65	3,000	14¾	12	24	Compound tandem	”	Sold, 1896.
City of Richmond	Inman	Glasgow	1874	468	441	43·5	34	4,623	9,320	1 of 76 1 of 120	5	0	70	4,000	15	10	30	Compound	”	Sold, 1891.
Britannic	White Star	Belfast	1874	468	455	45·2	33·7	5,004	9,600	2 of 48 2 of 83	5	0	75	5,100	16	8	32	Compound tandem	”	—
City of Berlin	Inman	Greenock	1875	520	488·5	44·2	35	5,491	10,100	1 of 72 1 of 120	5	6	75	5,200	16	12	36	2-crank compound	Screw	Sold, 1898.
Arizona	Guion	Glasgow	1879	475	450·2	45·4	35·7	5,147	9,900	1 of 62 2 of 90	5	6	90	6,300	16¼	7	39	3-crank compound	”	Laid up, 1894. Sold, 1898.

TABLE No. 1—*continued.*

Name of Ship.	Owners.	Where built.	Year.	Ship's Dimensions. Length. Over.	Length. B.P.	Breadth.	Depth.	Tonnage.	Displacement.	Engine Dimensions. Cylinders.	Stroke.	Pressure.	Indicated power.	Speed per hour.	No. of boilers.	Furnaces.	Type of engine.	How propelled.	Remarks
						ft.	ft.		tons.	Num. Dia.	ft. in.	lbs.							
Servia	Cunard	Glasgow	1881	532	515	52·1	37·9	7,392	12,300	1 of 72 2 of 100	6 6	90	12,000	16½	7	39	3-crank compound	Screw	—
City of Rome . .	Inman	Barrow	1881	600	560·2	52·3	37	8,144	13,500	3 of 46 3 of 86	6 0	90	11,500	17½	8	48	Tandem 3-crank compound	"	Laid up, 1894.
Alaska	Guion	Glasgow	1881	520	500	50	38	7,142	9,500	1 of 68 2 of 100	6 0	100	11,000	17¾	9	54	3-crank compound	"	Sold, 1898.
Notting Hill . .	Twin Screw	Do.	1881	435	420	45·1	26·5	3,920	6,210	2 of 32½ 2 of 76	4 0	100	2,800	12	3	18	Tandem single-crank com.	Twin screw	Sunk by ice, 1883.
Aurania . . .	Cunard	Glasgow	1882	485	470	57·2	37·3	7,269	13,360	1 of 68 2 of 91	6 0	90	8,500	17	7	39	3-crank compound	Single screw	—
Oregon	Guion & Cunard	Do.	1883	520	501	54·2	40	7,375	12,500	1 of 70 2 of 104	6 0	110	13,000	19	9	72	"	"	Sunk, 1886.
America . . .	National	Do.	1884	459	432	51·3	38·6	5,528	9,550	1 of 63 2 of 91	5 6	95	8,300	18¾	7	39	"	"	Sold, 1886.
Etruria	Cunard	Do.	1885	520	501	57·3	38·2	8,120	13,300	1 of 71 2 of 105	6 0	110	14,500	19½	9	72	"	"	—
Aller	North German	Glasgow	1886	455	438	48	34·6	5,400	10,460	1 of 44 1 of 70 1 of 108	6 0	150	8,200	16½	6	36	3-crank triple	Single screw	—
City of Paris [1]	Inman	Do.	1889	560	527·6	63·2	39·2	10,670	17,270	2 of 45 2 of 71 2 of 113	5 0	150	18,500	20	9	54	"	Twin Screw	—
Teutonic . . .	White Star	Belfast	1889	582	566	57·8	39·2	9,984	16,740	2 of 43 2 of 68 2 of 110	5 0	180	17,500	20	16	76	"	"	—
Fürst Bismarck .	Hamburg American	Stettin	1890	520	502·6	57·6	38	8,874	15,200	2 of 43¼ 2 of 67 2 of 106¼	5 3	160	17,000	19½	9	72	"	"	—

[1] Second of name.

TABLE No. 1—*continued.*

Name of Ship.	Owners.	Where built.	Year.	Ship's Dimensions. Length. Over.	Length. B.P.	Breadth.	Depth.	Tonnage.	Displacement.	Engine Dimensions. Cylinders. Num. Dia.	Stroke. ft.	Stroke. in.	Pressure.	Indicated power.	Speed per hour.	No. of Boilers.	Furnaces.	Type of engine.	How propelled.	Remarks.
						ft.	ft.		tons.		ft.	in.	lbs.							
La Touraine . .	Co. Gen. Transatlantique	S. Nazaire	1891	540	520·3	56	34·6	9,209	14,920	2 of 41 2 of 60½ 2 of 100	5	5⅜	160	16,000	18	9	45	3-crank triple	Twin screw	—
Campania . . .	Cunard	Glasgow	1893	620	598	65	43	12,950	21,000	4 of 37 2 of 79 4 of 98	5	9	165	30,000	22	13	100	Tandem triple 3-crank	,,	—
St. Louis . . .	American Line	Philadelphia	1895	554	535·7	63	42	11,630	16,000	4 of 28½ 2 of 55 2 of 77 4 of 77	5	0	200	20,500	20	10	64	4-crank quadruple	,,	—
Kaiser Wilhelm der Grosse . .	North German Line	Stettin	1897	648·5	625	66	43	14,350	23,760	2 of 52 2 of 89¾ 4 of 96½	5	9	178	32,000	22·8	14	104	4-crank triple	,,	—
Kaiser Friedrich.	North German Line	Dantzic	1898	600	584	64	41	12,000	20,100	2 of 43¼ 2 of 64¼ 2 of 92⅛ 4 of 93¼	5	9	225	27,000	21·5	9	72	3-crank quad.	Twin screw	—
Oceanic[1] . . .	White Star Line	Belfast	1899	704	685	68	49	16,900	26,100	2 of 47½ 2 of 79 4 of 93	6	0	192	29,000	21·5	16	96	4-crank triple	,,	—
Deutschland[1] .	Hamburg American	Stettin	1899	695	666	65·5	45·5	14,500	24,400	4 of 36⅝ 2 of 73½ 2 of 104 4 of 106⅜	6	0¾	225	36,000	23¼	16	112	Tandem quad. 4-crank.	,,	—
New S.S. . . .	North German Lloyd	Stettin			700	69	49	17,200	26,700					36,000	23½				,,	—

[1] Second of name—both Oceanic and Deutschland.

TABLE No. 2.—Rapid Passages made by Atlantic Steamers, from 1840 to 1899.

Outward.

Year.	Month.	Name.	Owner.	From	To.	Distance, knots.	Time occupied. D.	H.	M.	Average speed per hour.
1840	July	**Britannia**	Cunard Line	Liverpool	Boston	2755	14	8	0	8
1840	August	**Acadia**	Do.	Do.	Halifax	2487	11	4	0	9¼
1846	December	**Cambria**	Do.	Do.	Do.	2420	10	22	0	9¼
1848		**Europa**	Do.	Do.	New York	3047	11	3	0	11¼
1851	August	**Baltic**	Collins	Do.	Do.	3054	9	18	0	13
1864		**Scotia**	Cunard	Queenstown	Do	2783	8	15	45	13½
1866	July	**Do.**	Do.	Do.	Do.	2851	8	4	34	14
1867	November	**City of Paris** [1]	Inman	Do.	Do.	2700	8	4	1	13¾
1872	May	**Adriatic**	White Star	Do.	Do.	2778	7	23	17	14¼
1875	September	**City of Berlin**	Inman	Do.	Do.	2829	7	18	2	15
1876	November	**Britannic**	White Star	Do.	Do.	2795	7	13	11	15¼
1877	April	**Germanic**	Do.	Do.	Do.	2830	7	11	37	15½
1877	August	**Britannic**	Do.	Do.	Do.	2802	7	10	53	15¼
1880	May	**Arizona**	Guion	Do.	Do.	2761	7	10	47	15¼
1882	April	**Alaska**	Do.	Do.	Do.	2803	7	6	43	16
1884	August	**Oregon**	Do.	Do.	Do.	2792	6	9	42	19¼
1885	May	**Etruria**	Cunard	Do.	Do.	2821	6	5	31	19
1887	Do.	**Umbria**	Do.	Do.	Do.	2810	6	4	42	19¼
1888	Do	**Etruria**	Do.	Do.	Do.	2855	6	1	55	19½
1889	September	**City of Paris** [2]	Inman	Do.	Do.	2788	5	19	18	20
1891	August	**Teutonic**	White Star	Do.	Do.	2778	5	16	31	20½
1892	October	**City of Paris**	Inman	Do.	Do.	2782	5	14	24	21
1893	Do.	**Lucania**	Cunard	Do.	Do.	2775	5	13	45	21
1894	August	**Campania**	Do.	Do.	Do.	2785	5	9	45	21½
1894	October	**Lucania**	Do.	Do.	Do.	2779	5	7	23	21·85
1898	April	**Kaiser Wilhelm der Grosse**	North German	Do.	Do.	2800	5	4	40	22·29 [3]
1899	September	**Do.**	Do.	Do.	Do.	2800	5	2	35	22·86

[1] First City of Paris.   [2] Second City of Paris.   [3] Based on passage—Southampton to New York.

TABLE No. 3.—Rapid Passages made by Atlantic Steamers, from 1840 to 1899.

Homeward.

Year.	Month.	Name.	Owner.	From	To	Distance, knots.	Time occupied. D.	H.	M.	Average speed per hour.
1841	July	**Britannia**	Cunard Line	Halifax	Liverpool	2573	10	0	0	$10\frac{1}{4}$
1841	Do.	**Acadia**	Do.	Do.	Do.	2534	9	21	0	$10\frac{3}{4}$
1851	May	**Pacific**	Collins	New York	Do.	3078	9	20	26	13
1852	February	**Arctic**	Do.	Do.	Do.	3082	9	17	15	$13\frac{1}{4}$
1856	July	**Persia**	Cunard	Do.	Do.	3068	9	4	45	$13\frac{3}{4}$
1863	December	**Scotia**	Do.	Do.	Queenstown	2731	8	3	0	14
1869	Do.	**City of Brussels**	Inman	Do.	Do.	2786	7	22	3	$14\frac{1}{2}$
1873	January	**Baltic**	White Star	Do.	Do.	2840	7	20	9	15
1875	October	**City of Berlin**	Inman	Do.	Do.	2820	7	15	28	$15\frac{1}{4}$
1876	February	**Germanic**	White Star	Do.	Do.	2894	7	15	17	$15\frac{3}{4}$
1876	December	**Britannic**	Do.	Do.	Do.	2882	7	12	47	16
1879	July	**Arizona**	Guion	Do.	Do.	2810	7	8	11	16
1882	June	**Alaska**	Do.	Do.	Do.	2791	6	22	0	$16\frac{3}{4}$
1884	Do.	**America**	National	Do.	Do.	2815	6	14	8	$17\frac{1}{2}$
1884	August	**Oregon**	Guion	Do.	Do.	2853	6	11	9	$18\frac{1}{4}$
1887	March	**Etruria**	Cunard	Do.	Do.	2890	6	4	36	$19\frac{1}{2}$
1889	May	**City of Paris**	Inman	Do.	Do.	2894	6	0	29	20
1889	August	**Do.**	Do.	Do.	Do.	2792	5	23	38	$19\frac{3}{4}$
1889	December	**Do.**	Do	Do.	Do.	2784	5	22	50	$19\frac{3}{4}$
1891	October	**Teutonic**	White Star	Do.	Do.	2790	5	21	3	$19\frac{3}{4}$
1892	August	**City of New York**	Inman	Do.	Do.	2814	5	19	57	20
1893	May	**Campania**	Cunard	Do.	Do.	2828	5	17	27	$20\frac{1}{2}$
1894	Do.	**Lucania**	Do.	Do.	Do.	2823	5	8	38	22
1898	July	**Kaiser Wilhelm der Grosse**	North German	Do.	Do.	2840	5	4	21	22·51

TABLE No. 4.

Average Passages of Steamships of Atlantic Lines from 1850 to 1898.

Outward.

Year.	Cunard.			Inman.			Guion.			White Star.		
	D.	H.	M.	D.	H.	M.	D.	H.	M.	D.	H.	M.
1850	13	0	0		—			—			—	
1852	12	19	26		—			—			—	
1855	12	12	0		—			—			—	
1866	10	11	34	11	15	18		—			—	
1873	10	16	40	10	22	4	12	6	38	9	19	48
1875	10	17	24	10	20	45	11	8	47	9	16	33
1876	10	13	32	10	1	44	10	23	45	8	21	14
1877	10	5	23	9	7	21	10	3	30	8	18	27
1878	9	22	27	9	4	15	9	20	1	8	15	39
1879	9	23	48	9	12	6	9	20	40	8	21	12
1880	9	22	12	9	10	45	9	16	50	8	23	12
1881	10	6	29	9	12	52	9	23	55	8	21	40
1882	9	17	39	10	0	45	9	10	41	9	0	18
1883	9	11	15	9	17	3	9	9	5	8	20	29
1884	9	11	15	9	20	3	9	9	5	8	20	29
1885	8	0	54	9	13	42	9	18	23	8	16	22
1886	7	11	10	9	11	32	9	3	27	8	16	15
1887	7	10	38	9	23	37	8	22	43	8	14	4
1888	7	8	5	9	2	44	9	1	2	8	12	45
1889	7	10	30	8	3	28	9	6	51	8	7	27
1890	7	15	23	8	16	9	9	14	34	7	17	0
1891	7	4	22	7	21	11	9	4	38	7	5	25
1892	7	0	38	7	15	9	9	10	22	7	3	34
1893	6	20	35		Extinct			Extinct		7	6	33
1894	6	13	17		,,			,,		7	7	44
1895	6	6	37		,,			,,		7	4	50
1896	6	5	57		,,			,,		6	23	36
1897	6	9	42		,,			,,		7	5	5
1898	6	6	56		,,			,,		7	3	7

TABLE No. 5.

Average Passages of Steamships of Atlantic Lines from 1850 to 1898.

Homeward.

Year.	Cunard.			Inman.			Guion.			White Star.		
	D.	H.	M.	D.	H.	M.	D.	H.	M.	D.	H.	M
1850	12	16	0									
1855	11	12	0									
1866	9	4	39	10	11	40						
1873	9	7	59	10	0	2	10	20	18	8	22	39
1876	9	4	48	8	17	52	9	20	4	8	12	13
1877	9	5	59	8	21	51	9	12	54	8	11	9
1878	9	8	37	9	0	3	9	18	50	8	16	19
1879	9	3	26	8	22	33	9	9	46	8	10	32
1880	9	6	58	9	1	59	9	9	9	8	17	26
1881	9	9	29	9	2	18	9	11	14	8	13	54
1882	8	20	17	9	2	21	8	16	20	8	10	50
1883	8	20	46	9	2	55	8	13	1	8	11	6
1884	9	2	14	9	7	37	8	22	6	8	13	21
1885	7	14	36	9	2	19	9	5	34	8	6	44
1886	7	3	29	9	2	18	8	18	52	8	6	42
1887	7	5	46	9	8	6	8	15	10	8	5	9
1888	7	0	31	8	18	5	8	15	47	8	3	46
1889	7	2	40	7	23	23	8	14	1	7	22	7
1890	7	4	52	8	6	37	8	20	6	7	6	16
1891	6	23	23	7	16	47	9	4	38	7	0	48
1892	7	1	0	7	12	36	9	10	33	7	1	30
1893	6	15	51		Extinct			Extinct		7	2	48
1894	6	5	56		"			"		7	1	16
1895	6	4	6		"			"		7	1	4
1896	6	0	16		"			"		6	21	10
1897	6	4	23		"			"		7	0	34
1898	6	3	29		"			"		6	21	43

TABLE No. 6.

List of Steamships and Number of lives Lost on the Atlantic Ferry from 1840 to 1899.

Year.	Month.	No.	Name of vessel.	Owners.	Nationality.	No. of lives lost.	How lost.	Where.
1841	March 11	1	**President**	Brit. and Amer. S. N. Co.	British	136	Never heard of	
1843	July 1	2	**Columbia**	Cunard Line	Do.	None	Wrecked	
1850	Nov.	3	**Helen Sloman**		German	9	Do.	
1852	Dec. 24	4	**St. George**		British	51	Burned	
1853	Dec. 5	5	**Humboldt**	New York and Havre S.	American	1	Wrecked	Halifax
1854	March 1	6	**City of Glasgow**	Inman Line	British	480	Never heard of	
1854	July 17	7	**Franklin**	New York and Havre S. In. Co.	American	None	Wrecked	Long Island
1854	Sept. 9	8	**City of Philadelphia**	Inman Line	British	Do.	Wrecked	Cape Race
1854	Sept. 27	9	**Arctic**	Collins Line	American	322	Collision	At sea
1856	June 29	10	**St. Denis**	French	French	46	Wrecked	
1856	Sept. 23	11	**Pacific**	Collins Line	American	240	Never heard of	
1856	Nov. 2	12	**Le Lyonnais**	French	French	120	Collision	Nantucket
1857	Feb. 26	13	**Tempest**	Anchor Line	British	150	Never heard of	
1857	June 1	14	**Canadian**	Allan Line	Do.	None	Wrecked	
1858	June 13	15	**New York**	Glas. and New York S. Co.	Do.	Do.	Do.	Mull of Kintyre
1858	Sept. 13	16	**Austria**	Hamburg-American Line	German	470	Burned	At sea
1859	June 28	17	**Argo**	Galway Line	British	None	Wrecked	Newfoundland
1859	Nov. 21	18	**Indian**	Allan Line	Do.	27	Do.	Nova Scotia
1860	Feb. 20	19	**Hungarian**	Do.	Do.	237	Do.	Sable Island
1860	Oct. 7	20	**Connaught**	Galway Line	Do.	None	Burned	Massachusetts
1861	June 4	21	**Canadian**	Allan Line	Do.	35	Coll. with iceberg	Straits of Belleisle
1861	Nov. 5	22	**North Briton**	Do.	Do.	None	Wrecked	Paraquet Island
1863	April 27	23	**Anglo-Saxon**	Do.	Do.	237	Do.	Cape Race
1863	June 14	24	**Norwegian**	Do.	Do.	None	Do.	St. Paul Island

TABLE No. 5.

Average Passages of Steamships of Atlantic Lines from 1850 to 1898.

Homeward.

Year.	Cunard.			Inman.			Guion.			White Star.		
	D.	H.	M.	D.	H.	M.	D.	H.	M.	D.	H.	M
1850	12	16	0									
1855	11	12	0									
1866	9	4	39	10	11	40						
1873	9	7	59	10	0	2	10	20	18	8	22	39
1876	9	4	48	8	17	52	9	20	4	8	12	13
1877	9	5	59	8	21	51	9	12	54	8	11	9
1878	9	8	37	9	0	3	9	18	50	8	16	19
1879	9	3	26	8	22	33	9	9	46	8	10	32
1880	9	6	58	9	1	59	9	9	9	8	17	26
1881	9	9	29	9	2	18	9	11	14	8	13	54
1882	8	20	17	9	2	21	8	16	20	8	10	50
1883	8	20	46	9	2	55	8	13	1	8	11	6
1884	9	2	14	9	7	37	8	22	6	8	13	21
1885	7	14	36	9	2	19	9	5	34	8	6	44
1886	7	3	29	9	2	18	8	18	52	8	6	42
1887	7	5	46	9	8	6	8	15	10	8	5	9
1888	7	0	31	8	18	5	8	15	47	8	3	46
1889	7	2	40	7	23	23	8	14	1	7	22	7
1890	7	4	52	8	6	37	8	20	6	7	6	16
1891	6	23	23	7	16	47	9	4	38	7	0	48
1892	7	1	0	7	12	36	9	10	33	7	1	30
1893	6	15	51	Extinct			Extinct			7	2	48
1894	6	5	56	"			"			7	1	16
1895	6	4	6	"			"			7	1	4
1896	6	0	16	"			"			6	21	10
1897	6	4	23	"			"			7	0	34
1898	6	3	29	"			"			6	21	43

TABLE No. 6.

LIST OF STEAMSHIPS AND NUMBER OF LIVES LOST ON THE ATLANTIC FERRY FROM 1840 TO 1899.

Year.	Month.	No.	Name of vessel.	Owners.	Nationality.	No. of lives lost.	How lost.	Where.
1841	March 11	1	**Pr sident**	Brit. and Amer. S. N. Co.	British	136	Never heard of	
1843	July 1	2	**Columbia**	Cunard Line	Do.	None	Wrecked	
1850	Nov.	3	**Helen Sloman**		German	9	Do.	
1852	Dec. 24	4	**St. George**		British	51	Burned	
1853	Dec. 5	5	**Humboldt**	New York and Havre S.	American	1	Wrecked	Halifax
1854	March 1	6	**City of Glasgow**	Inman Line	British	480	Never heard of	
1854	July 17	7	**Franklin**	New York and Havre S. In. Co.	American	None	Wrecked	Long Island
1854	Sept. 9	8	**City of Philadelphia**	Inman Line	British	Do.	Wrecked	Cape Race
1854	Sept. 27	9	**Arctic**	Collins Line	American	322	Collision	At sea
1856	June 29	10	**St. Denis**	French	French	46	Wrecked	
1856	Sept. 23	11	**Pacific**	Collins Line	American	240	Never heard of	
1856	Nov. 2	12	**Le Lyonnais**	French	French	120	Collision	Nantucket
1857	Feb. 26	13	**Tempest**	Anchor Line	British	150	Never heard of	
1857	June 1	14	**Canadian**	Allan Line	Do.	None	Wrecked	
1858	June 13	15	**New York**	Glas. and New York S. Co.	Do.	Do.	Do.	Mull of Kintyre
1858	Sept. 13	16	**Austria**	Hamburg-American Line	German	470	Burned	At sea
1859	June 28	17	**Argo**	Galway Line	British	None	Wrecked	Newfoundland
1859	Nov. 21	18	**Indian**	Allan Line	Do.	27	Do.	Nova Scotia
1860	Feb. 20	19	**Hungarian**	Do.	Do.	237	Do.	Sable Island
1860	Oct. 7	20	**Connaught**	Galway Line	Do.	None	Burned	Massachusetts
1861	June 4	21	**Canadian**	Allan Line	Do.	35	Coll. with iceberg	Straits of Belleisle
1861	Nov. 5	22	**North Briton**	Do.	Do.	None	Wrecked	Paraquet Island
1863	April 27	23	**Anglo-Saxon**	Do.	Do.	237	Do.	Cape Race
1863	June 14	24	**Norwegian**	Do.	Do.	None	Do.	St. Paul Island

TABLE No. 6—*continued.*

Year.	Month.	No.	Name of vessel.	Owners.	Nationality.	No. of lives lost.	How lost.	Where.
1863	Aug. 4	25	**Georgia**	National Line	British	None	Wrecked	Sable Island
1864	Feb. 22	26	**Bohemian**	Allan Line	Do.	20	Do.	Cape Elizabeth
1864	March 29	27	**City of New York**	Inman Line	Do.	None	Do.	Daunts Rck, Qnstown
1864	Nov. 3	28	**Jura**	Chartered by Allan Line	Do.	Do.	Do.	Near Liverpool
1864	Dec. 10	29	**Iowa**	London Line	Do.	Do.	Do.	Cherbourg
1865	July 31	30	**Glasgow**	Inman Line	Do.	Do.	Burned	Nantucket
1866	Dec. 1	31	**Scotland**	National Line	Do.	Do.	Collision	At sea
1868	January	32	**Chicago**	Guion Line	Do.	Do.	Wrecked	Daunts Rck, Qnstown
1868	April 17	33	**United Kingdom**	Anchor Line	Do.	80	Never heard of	
1868	Nov. 25	34	**Hibernia**	Do.	Do.	66	Foundered	
1869	Aug. 7	35	**Germania**	Hamburg-American Line	German	None	Wrecked	Cape Race
1869	Aug. 8	36	**Cleopatra**	Canadian Line	British	Do.	Wrecked	Newfoundland
1870	Jan. 28	37	**City of Boston**	Inman Line	Do.	177	Never heard of	
1870	Oct. 19	38	**Cambria**	Anchor Line	Do.	190	Wrecked	N. W. coast of Ireland
1872	April 7	39	**Dacian**	Allan Line	Do.	None	Do.	Halifax
1872	Oct. 8	40	**Scanderia**	Anglo-Egyptian Line	Do.	38	Never heard of	
1872	Dec. 3	41	**Germany**	Allan Line	Do.	30	Wrecked	Near Bordeaux
1873	Jan. 27	42	**Britannia**	Anchor Line	Do.	None	Do.	Arran Island
1873	April 1	43	**Atlantic**	White Star Line	Do.	585	Do.	Near Halifax
1873	May 17	44	**Tripoli**	Cunard Line	Do.	None	Do.	Tuskar Rock
1873	July 7	45	**City of Washington**	Inman Line	Do.	Do.	Do.	Nova Scotia
1873	Sept. 27	46	**Ismailia**	Anchor Line	Do.	52	Never heard of	
1873	Oct. 1	47	**Missouri**	Dominion Line	Do.	None	Wrecked	Bahamas
1873	Nov. 22	48	**Ville de Havre**	Transatlantique Line	French	226	Collision	At sea
1873	Dec.	49	**Colorado**	Guion Line	British	6	Do.	River Mersey
1874	April 3	50	**Europe**	Transatlantique Line	French	None	Foundered	At sea
1875	May 7	51	**Schiller**	Eagle Line	German	312	Wrecked	Scilly Islands
1875	June 2	52	**Vicksburg**	Dominion Line	British	47	Coll. with iceberg	Off Newfoundland

TABLE No. 6—*continued.*

Year.	Month.	No.	Name of vessel.	Owners.	Nationality.	No. of lives lost.	How lost.	Where.
1875	June 19	53	**Abbotsford**	Chartered by Amer. Line	British	None	Wrecked	Anglesea
1876	Dec. 6	54	**Deutschland**	Norddeutscher Line	German	52	Do.	Goodwin Sands
1877	Jan.	55	**Colombo**	Wilson Line	British	44	Never heard of	
1877	Feb. 6	56	**Bavaria**	Dominion Line	Do.	None	Burned	At sea
1877	March 17	57	**Rusland**	Red Star Line	Belgian	Do.	Wrecked	Long Island
1877	May	58	**Dakota**	Guion Line	British	Do.	Do.	North Wales
1878	June 1	59	**Idaho**	Do.	Do.	Do.	Do.	Coast of Wexford
1878	July 30	60	**Lake Megantic**	Beaver Line	Do.	Do.	Do.	Anticosta
1878	Sept. 28	61	**Herman Ludwig**	Steinman	Belgian	50	Never heard of	
1878	Sept.	62	**Yoxford**	Swan and Co.	British	None	Foundered	At sea
1878	Nov. 26	63	**Pomerania**	Hamburg-American Line	German	50	Collision	Off Dover
1878	Dec. 4	64	**Bayard**	Kay and Co.	British	None	Foundered	At sea
1878	Dec. 17	65	**Homer**	Glover and Co.	Do.	43	Never heard of	
1879	Jan. 11	66	**Zanzibar**		Do.	48	Do.	
1879	Feb. 18	67	**Surbiton**	Watts and Co.	Do.	33	Do.	
1879	March 19	68	**Bernicia**		Do.	45	Do.	
1879	July 15	69	**State of Virginia**	State Line	Do.	9	Stranded	Sable Island
1879	Dec. 2	70	**Borussia**	Dominion Line	Do.	165	Foundered	At sea
1880	Feb. 10	71	**Hindoo**	Wilson Line	Do.	6	Do.	Do.
1880	March 14	72	**Montana**	Guion Line	Do.	None	Wrecked	Anglesea
1880	Sept. 10	73	**Anglia**	Anchor Line	Do.	Do.	Collision	At sea
1880	Dec. 31	74	**Brazilian**	Chart. by Warren Line	Do.	Do.	Wrecked	Near Liverpool
1881	Jan. 8	75	**City of Limerick**	Ross Line	Do.	43	Never heard of	
1881	Jan. 22	76	**Titania**	Gribel and Co.	German	27	Do.	
1881	Feb. 7	77	**Bohemian**	Leyland Line	British	33	Wrecked	Near Crookhaven
1881	March 3	78	**Drumduff**		Do.	1	Foundered	At sea
1881	April 16	79	**Beleize**		Do.	None	Do.	Do.
1881	May 29	80	**Macedonia**	Anchor Line	Do.	Do.	Stranded	Mull of Kintyre

TABLE No. 6—*continued.*

Year.	Month.	No.	Name of vessel.	Owners.	Nationality.	No. of lives lost.	How lost.	Where.
1896	Nov. 18	137	**Memphis**	Dom. Line, Bristol Route	British	9	Stranded	Near Mizen Head
1896	Dec. 23	138	**State of Georgia**	Aberdeen Atlantic Line	Do.	32	Never heard of	
1897	Feb. 3	139	**Angloman**	Dominion Line	Do.	None	Stranded	On South Stack
1897	April 5	140	**Assaye**	Chartered by Beaver Line	Do.	Do.	Wrecked	Bay of Fundy
1897	July 19	141	**Baltimore City**	Furness Line	Do.	Do.	Do.	Belleisle
1898	Jan. 19	142	**Lord O'Neill**	Lord Line	Do.	Do.	Do.	Coast of Kerry, Ireland
1898	Feb. 6	143	**Veendam**	Netherlands Amer. Line	Dutch	Do.	Foundered	At sea
1898	July 4	144	**La Bourgoyne**	Transatlantique Line	French	549	Collision	Off Sable Island
1898	Oct. 14	145	**Mohegan**	Atlantic Transport Line	British	108	Wrecked	Manacles, Cornwall
1898	Nov. 7	146	**Westmeath**	Hudson Line	Do.	1	Foundered	At sea
1898	Nov. 25	147	**Londonian**	Wil., Furn., Leyland Line	Do.	18	Do.	Do.
1899	Jan. 27	148	**Port Melbourne**	Chartered by Natl. Line	Do.	52	Never heard of	
1899	Feb. 8	149	**Rossmore**	Johnston Line	Do.	None	Foundered	
1899	Feb. 12	150	**Moravia**	Chtd. from Ham. Am. Line	German	Do.	Wrecked	Sable Island
1899	March 1	151	**Labrador**	Dom. Line L'pool Service	British	Do.	Do.	Skerryvore, Scotland
1899	„ 11	152	**Oswestry**	Sieveright Bacon Line	Do.	Do.	Do.	Crookhaven, Ireland
1899	„ „	153	**Castillian**	Allan Line	Do.	Do.	Do.	Bay of Fundy
1899	„ 29	154	**Norseman**	Warren Line	Do.	Do.	Do.	Marblehead, nr Boston
1899	Sept. 22	155	**Scotsman**	Dominion Line	Do.	15	Do.	Belle Isle
1899	Oct.	156	**Bay State**	Warren Line	Do.	None	Do.	Massachusetts
1899	Nov. 17	157	**Patria**	Ham. American Line	German	Do.	Burned	English Channel
1899	Nov. 18	158	**Manchester Enterprize**	Manchester Liners	British	Do.	Foundered	At sea

Total number of lives lost through steamship disasters . . 8109
Estimated loss through various causes 200

Total number of lives lost . . . . 8309 from 1840 to 1899.

NOTE.—Dates given for vessels never heard of are dates of sailing from ports.

TABLE No. 6—*continued.*

Year.	Month.	No.	Name of vessel.	Owners.	Nationality.	No. of lives lost.	How lost.	Where.
1887	Jan. 14	109	**Celtic Monarch**	Monarch Line	British	None	Foundered	Off coast of Ireland
1887	Aug. 12	110	**City of Montreal**	Inman Line	Do.	Do.	Burned	At sea
1887	Nov. 19	111	**W. A. Scholten**	Dutch Line	Dutch	130	Collision	English Channel
1887	Dec. 23	112	**Newcastle City**	Furness Line	British	None	Foundered	At sea
1888	Aug. 14	113	**Geiser**	Thingvalla Line	Danish	119	Collision	Off Sable Island
1889	April 6	114	**Danmark**	Do.	Do.	None	Foundered	At sea
1889	May 22	115	**Cynthia**	Donaldson Line	British	8	Collision	River St. Lawrence
1889	Oct. 27	116	**Queensmore**	Johnston Line	Do.	None	Burned	At sea
1889	Dec. 31	117	**Erin**	National Line	Do.	72	Never heard of	
1890	July 19	118	**Egypt**	Do.	Do.	None	Burned	At sea
1890	Nov. 26	119	**Thanemore**	Johnston Line	Do.	43	Never heard of	
1891	Feb. 22	120	**Iowa**	Warren Line	Do.	None	Coll. with iceberg	
1891	March 17	121	**Utopia**	Anchor Line	Do.	563	Collision	Gibraltar Bay
1891	July 18	122	**Circe**	Donaldson Line	Do.	5	Stranded	Anticosti
1891	Dec.	123	**Abyssinia**	Guion Line	Do.	None	Burned	At sea
1892	Jan. 31	124	**Eider**	Norddeutscher Line	German	Do.	Stranded	Isle of Wight
1892	July 1	125	**City of Chicago**	Inman Line	British	Do.	Do.	South coast of Ireland
1893	Feb. 11	126	**Naronic**	White Star Line	Do.	74	Never heard of	
1894	March 12	127	**De Reuter**	Engels	Belgian	37	Do.	
1894	June 5	128	**Texas**	Dominion Line	British	None	Wrecked	Newfoundland
1894	Aug. 19	129	**Horn Head**	Head Line	Do.	30	Never heard of	
1894		130	**Persian Monarch**	Wilson Hill Line	Do.	None	Wrecked	Long Island
1895	Jan. 30	131	**Elbe**	Norddeutscher Line	German	335	Collision	North Sea
1895	March	132	**Virginian**	Furness Line	British	None	Stranded	Near Boston
1895	July 7	133	**Mexico**	Dom. Line, Bristol Route	Do.	Do.	Do.	Straits of Belleisle
1895	Sept.	134	**Edam**	Netherlands American	Dutch	Do.	Collision	Off Isle of Wight
1895	Oct.	135	**Mariposa**	Dom. Line, Bristol Route	British	Do.	Stranded	River St. Lawrence
1896	Aug. 19	136	**Moldavia**	Mercantile Line	Do.	Do.	Collision with ice	At sea

TABLE No. 6—*continued.*

Year.	Month.	No.	Name of vessel.	Owners.	Nationality.	No. of lives lost.	How lost.	Where.
1896	Nov. 18	137	**Memphis**	Dom. Line, Bristol Route	British	9	Stranded	Near Mizen Head
1896	Dec. 23	138	**State of Georgia**	Aberdeen Atlantic Line	Do.	32	Never heard of	
1897	Feb. 3	139	**Angloman**	Dominion Line	Do.	None	Stranded	On South Stack
1897	April 5	140	**Assaye**	Chartered by Beaver Line	Do.	Do.	Wrecked	Bay of Fundy
1897	July 19	141	**Baltimore City**	Furness Line	Do.	Do.	Do.	Belleisle
1898	Jan. 19	142	**Lord O'Neill**	Lord Line	Do.	Do.	Do.	Coast of Kerry, Ireland
1898	Feb. 6	143	**Veendam**	Netherlands Amer. Line	Dutch	Do.	Foundered	At sea
1898	July 4	144	**La Bourgoyne**	Transatlantique Line	French	549	Collision	Off Sable Island
1898	Oct. 14	145	**Mohegan**	Atlantic Transport Line	British	103	Wrecked	Manacles, Cornwall
1898	Nov. 7	146	**Westmeath**	Hudson Line	Do.	1	Foundered	At sea
1898	Nov. 25	147	**Londonian**	Wil., Furn., Leyland Line	Do.	18	Do.	Do.
1899	Jan. 27	148	**Port Melbourne**	Chartered by Natl. Line	Do.	52	Never heard of	
1899	Feb. 8	149	**Rossmore**	Johnston Line	Do.	None	Foundered	
1899	Feb. 12	150	**Moravia**	Chtd. from Ham. Am. Line	German	Do.	Wrecked	Sable Island
1899	March 1	151	**Labrador**	Dom. Line L'pool Service	British	Do.	Do.	Skerryvore, Scotland
1899	,, 11	152	**Oswestry**	Sieveright Bacon Line	Do.	Do.	Do.	Crookhaven, Ireland
1899	,, ,,	153	**Castillian**	Allan Line	Do.	Do.	Do.	Bay of Fundy
1899	,, 29	154	**Norseman**	Warren Line	Do.	Do.	Do.	Marblehead, nr Boston
1899	Sept. 22	155	**Scotsman**	Dominion Line	Do.	15	Do.	Belle Isle
1899	Oct.	156	**Bay State**	Warren Line	Do.	None	Do.	Massachusetts
1899	Nov. 17	157	**Patria**	Ham. American Line	German	Do.	Burned	English Channel
1899	Nov. 18	158	**Manchester Enterprize**	Manchester Liners	British	Do.	Foundered	At sea

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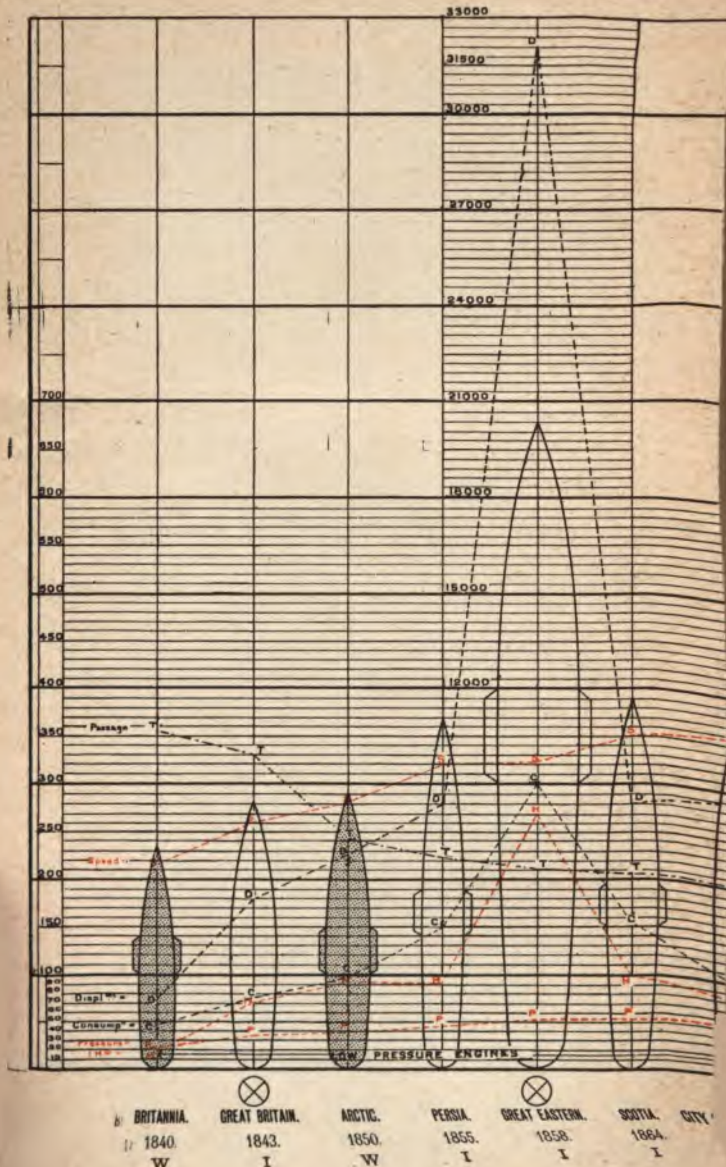
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